European Landscape Character Areas

Typologies, Cartography and Indicators for the Assessment of Sustainable Landscapes

Edited by
Dirk M. Wascher

LANDSCAPE EUROPE

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Final Project Report

Project: FP5 EU Accompanying Measure
Contract: ELCAI-EVK2-CT-2002-80021
Home page: www.elcai.org
Co-ordinator: Dirk Wascher

ELCAI
European Landscape Character Assessment Initiative

LANDSCAPE EUROPE

This report is based on the EU Accompanying Measure Project "European Landscape Character Assessment Initiative" (ELCAI).

Alterra Report No. 1254/December 2005

This publication should be cited as follows:
Wascher, D.M. (ed). 2005. European Landscape Character Areas – Typologies, Cartography and Indicators for the Assessment of Sustainable Landscapes. Final Project Report as deliverable from the EU's Accompanying Measure project *European Landscape Character Assessment Initiative* (ELCAI), funded under the 5th Framework Programme on Energy, Environment and Sustainable Development (4.2.2), x + 150 pp.

Published by Landscape Europe in collaboration with ELCAI project partners:
Alterra, The Netherlands
Norwegian Institute for Landscape Inventory (NIJOS), Norway
Landscape Alliance Ireland (LAI), Ireland
Institute of Ecology and Conservation Biology (IECB), University of Vienna, Austria
Swiss Federal Institute of Forest, Snow and Landscape (WSL), Switzerland
Institut National de la Recherch Agronomique (INRA), France
Czech Agricultural University Prague (CAU), Czech Republic
University of Western Hungary (UWH), Hungary
Autonomous University of Madrid (AUM), Spain
Centre for Agricultural Landscape and Land Use Research (ZALF), Germany
European Centre for Nature Conservation (ECNC), The Netherlands
National Environmental Research Institute (NERI), Denmark
Centre for Environmental Research Leipzig Halle (UFZ), Germany
University of Nottingham, England
Institute of Nature Conservation (INB), Belgium
University of Évora, Portugal

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Cover design: NatureBureau International, using images from the editor
Designed by: NatureBureau International, 36 Kingfisher Court, Hambridge Road, Newbury, Berkshire RG14 5SJ, UK
Printed by Information Press, Oxford, UK

http://www.landscape-europe.net

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Acknowledgements

I herewith would like to thank all ELCAI partners for providing their valuable input throughout the project implementation:
Wenche Dramstadt and Wendy Fjellstad, Norwegian Institute of Land Inventory (NIJOS);
Terry O'Regan and Cathy Buchanan, Landscape Alliance Ireland (LAI);
Felix Kienast and Peter Longatti, Swiss Federal Research Institute, Switzerland (WSL);
Thomas Wrbka and Andrea Kiss, University of Vienna, Austria (IECB);
Jacques Baudry and Claudine Thenail, INRA SAD-Armorique, France (INRA);
Zdnek Lipsky and Dušan Romportl, Czech Agricultural University Prague (CAU);
Éva Konkoly Gyuró, University of Western Hungary (UWH);
Rafael Mata Olmo and Joana Modolell, Autonomous University of Madrid, Spain (AUM);
Ulrich Stachow and Gerd Lutze, Center for Agricultural Landscape and Land Use Research, Germany (ZALF);
Tatiana Damarad, Ana Nieto and Ben Delbaere, European Centre for Nature Conservation (ECNC);
Geoff Groom and Pia Frederiksen, National Environmental Research Institute, Denmark (NERI);
Annegret Kindler, Centre for Environmental Research, Leipzig-Halle, Germany (UFZ);
Roy Haines-Young and Marion Potschin, Nottingham University, UK;
Geert de Blust, Institute of Nature Conservation, Belgium (INB); and
Teresa Pinto-Correia and Ana Paixã Ferreira, University of Évora, Portugal.

The scientific work presented and compiled in this report is based on original contributions by the experts as referenced in the table of contents and in the heading of each chapter. The experts maintain full rights of authorship for their contributions.

Parts of this project report draw upon targeted contributions to the ELCAI Policy Brochure[1] as well as on input by external authors. I would like to especially thank the following persons:
Maguelonne Déjeant-Pons[1], Council of Europe, Luxembourg;
Carol Somper[1], The Forum for the Future, UK;
Jean-Louis Weber[1], European Environmental Agency, Denmark;
Celia García-Feced[1], Alterra, The Netherlands;
Marta Pérez-Soba and Sander Mücher[1], Alterra, The Netherlands;
Isabel Ripa Julia and Michael Green[2], formerly UNEP-WCMC, UK; and
Paul Reich[3], USDA Natural Resources Conservation Service, USA.

Special appreciation also deserves the group of stakeholders who have actively participated at the ELCAI International Stakeholder Workshop (June 2004 in Évora, Portugal) and contributors to an earlier ELCAI-inspired publication on transboundary landscapes[4]:
José Festas, Direccão General do Ordenamento do Território e Desenvolvimento Urbane;
Javier Gallego, Institute for Environment and Sustainability, Italy (JRC-IES);
Gordon Sillence, Instituto Português de Ecologia, Portogal (INPECO);
Teresa Avelar, Ministério da Agricultura, DO Desenvolvimento Rural e das Pecas;
Marie-Alice Budniok and Thierry de l'Escaille, European Landowners' Organisation, Brussels, Belgium (ELO);
Lisa Davies, European Travel Commission, Brussels, Belgium;
Luc Bas, Network of Regional Governments for Sustainable Development, Brussels, Belgium;
Nuno Lecoq, Comissão de Co-ordenacão para o Desenvolvimento da Região Alentejo;
Joël Rochard and Laurence Stevez, Centre Technique Interprofessionnelle de la Vigne et du Vin, France (ITV); and
David Eager, Countryside Council for Wales, UK (CCW).

In addition I would like to thank my colleagues at Alterra, especially:
Sander Mücher, for his commitment and expertise in developing a LANMAP as an indispensible contribution to ELCAI and other projects;
Elizabeth Rijksen, for overcoming some severe administrative obstacles and for keeping track of costs and minutes;
Michiel van Eupen, for providing first aid support in data management and transfer from and to partners;
Bas Pedroli and Marta Pérez-Soba for assisting with their experience and advice throughout the project.

Last but not least I would like to express my sincere gratitude to **Denis Peter** and **Marie Yeroyanni** of the European Commission's DG Research for stimulating, guiding and accompanying the project from its start-up phase in spring 2003 until its finalisation in summer 2005.

Dirk M. Wascher
Project Co-ordinator and Report Editor

1 Perez-Soba, M. and Wascher, D.M. (eds). 2005. Landscape Character Areas. Places for building a sustainable Europe. Policy Brochure as deliverable from the EU's Accompanying Measure Project European Landscape Character Assessment Initiative (ELCAI), funded under the 5th Framework Programme on Energy, Environment and Sustainable Development (4.2.2), 33 pp.
2 Wascher, D.M. and Jongman, R.H.G. (eds), 2000. European landscapes – classification, evaluation and conservation. EEA, Environment Technical Reports, European Environment Agency, Copenhagen (not published).
3 Contribution in Chapter 2 on the World Map of Anthropic Systems.
4 Wascher, D.M. and Pérez-Soba, M. (eds) 2004. Learning from Transfrontier Landscapes – Project in Support of the European Landscape Convention. Alterra Wageningen UR, Wageningen, The Netherlands. Alterra rapport 964. 58 pp.

Executive Summary

In recent years, Landscape Character Assessment (LCA) has become central to sustainable development and the management of land. It is recognised as an important tool for policy stakeholders, which provides them with quantitative and qualitative evidence to reach a dynamic management, adjustable to new demands of regional identity. In response to this need, the expert network LANDSCAPE EUROPE launched the European Landscape Character Assessment Initiative (ELCAI) as an EU project. ELCAI's objective was to review the state-of-the-art of landscape character assessment techniques among its 14 participating countries and to analyse the role of policies and stakeholders at various levels.

According to the project group agreement, Landscape Character Assessment is a technique that is scientifically sound, region-specific and stakeholder orientated, designed to describe landscape character. It can be applied at a range of scales, from the national, though to the regional and local. It may also integrate landscape character analysis with biodiversity assessments, the analysis of historical character, air, water and soil quality, and socio-economic functions such as recreation and agriculture. So, in essence Landscape Character Assessment is primarily concerned with documenting landscape character rather than assigning quality or value. It therefore implies a distinction between *characterisation* and *judgement*.

Scientific review of Landscape Character Assessments

Data were gathered on a total of 51 individual LCA examples, most of these presented through completion and submission of the questionnaire checklists. The reviewed set also includes three examples of LCA that have been applied on multi-nation extents. The scientific review is structured around four core aspects of the LCA examples:

- the general modes of LCA activities across Europe;
- the spatial properties of the products from European LCA activities;
- the criteria considered relevant to making LCA; and
- the methods used to make LCA.

As a broad approximation, both the 'relevant criteria' and 'method' aspects were considered to comprise a 'natural spectrum' of components. It was found meaningful and useful to integrate analysis of these two aspects through use of a *comprehensive matrix* in which all national and international LCA examples have been included for allowing cross-comparisons and description.

Several European countries (e.g. Czech Republic, England, Scotland, Wales, and France) have in recent years, as well as making actual LCAs, produced detailed guidelines for the making of LCAs for regional or local extents. These guidelines cover LCA very thoroughly, describing and discussing the principles and processes involved. The aim here is not to replicate those works, but to identify and discuss the SOTA of the more scientific and technical aspects that emerge from this review. Thus, considering the current situation a number of important features that shape the SOTA for European LCA work can be noted:

- Recognition of the difference between and significance of LCA work addressing both landscape character types (LC-Types) and Landscape Character Areas (LC-Areas). Furthermore, that LC-Types relate to homogeneity, and LC-Areas can also relate to heterogeneity, i.e. distinctive patterns of landscape, such as microgeochores that give "sense of place".
- That the defining of LC-Types or LC-Areas and drawing of map lines by interpretation of map data by individuals or small committees of "experts" does not represent an effective, sufficiently objective way of working.
- For definition and mapping of LC-Areas factors covering natural science, human use and human experience of the landscape are essential.
- That for mapping of both LC-Types and LC-Areas automated GIS-based techniques can provide vital assistance, but should be followed-up by interactive (field-based, workshop-based) and objective examination and refinement of the outputs.
- A recognition that LCA work addressing LC-Areas cannot be achieved through merely traditional, natural sciences working methodologies, but must also draw upon consultative and textual methods that are more familiar within the social sciences and humanities (see also the "Stakeholder Review" chapter in this report).
- A strong appreciation of the planning and land use policy contexts relating to LCA work (see also "Policy Review"). This is one of the strongest contrasts between modern and earlier LCA work, in that the latter develops the academic and scientific aspects primarily, without explicit consideration of how the resulting landscape description, definition and delimitation might serve society or interact with other environmental activities. Clearly the whole context of environmental work has changed through the last 80 years.

Spatial review of landscape character mapping

The spatial review was mainly drawing upon the European Landscape Typology and Map (LANMAP2). The map provides an overview of European landscapes

and as well as background information and common language for monitoring landscape trends at the European level. However, the partner questionnaire demonstrated, that the map requires further improvements in order to meet the interest at the national level. The investigations led to the following findings:

- As expected the analysis of national landscape classifications/typologies has shown the partly great distinctions between European countries. Different input parameter, methodologies and spatial resolutions are the cause for the diversity of national landscape classifications.
- There is a great need of a agreed-upon European-wide landscape classification/typology to overcome the incoherence especially in transfrontier landscapes and to fill the gap of missing national classifications.
- The LANMAP2 represents a new generation of landscape classification and mapping. It demonstrates how traditional methods could be complemented by computer-driven methods. With the availability of new techniques and European-wide datasets new ways can be established for standardising landscape classifications, in order to produce more comparable, more transparent, more reproducible, and to some degree more objective and accurate results.
- The four input criteria parent material, topography, land cover, and climate are definitely important landscape characteristics for a landscape typology on the European level. But their accuracy and details, e.g. the created altitude classes, have to be checked and redefined.
- There is a clear quest for integrating further components into the classification such as slope, additional soil types and possibly precipitation. Information about landscape history, visual, cultural and aesthetic aspects of landscapes (e.g. data on linear elements) should be integrated. It also deems useful to link up with information on socio-economic characteristics as well as on environmental conflict or hazard zones.

The European landscape typology and map can be considered an innovative approach and a useful basis for further investigations and discussions towards a European-wide consistent and international accepted landscape classification for scientific and policy purposes.

Landscape character indicators

The objective of this work package was to examine possible methodological approaches for selecting landscape character indicators as part of a wider European concept. In order to achieve this goal, the work has:

- examined the conceptual basis of landscape indicators and the way they have been developed in through recent European initiatives;
- undertaken a survey of recent policy applications that cover a landscape related issues; and
- developed a typology of landscape indicators that can be used as a framework by those concerned with describing landscape and landscape change at the European scales.

ELCAI partners were asked to review the rationale for the three landscape ENRISK indicators (openness, coherence and diversity) and two IRENA indicators (state and diversity), together with the practicalities of developing them the European scales, and in particular the opportunity offered by the spatial framework of the European Landscape Classification (LANDMAP2). Respondents generally felt that as landscape indicators at the European scale, the rationale for the ENRISK indicators was more secure than those of IRENA, and that, despite some qualifications, it was feasible to develop such measures at European scales, given the availability of CORINE land cover change data. Linking these finding with those of the other sections of the survey it is clear that while such an exercise is technically feasible interpretation of the significance of change in the ENRISK indicators by the spatial units of LANDMAP2, would be difficult, unless the latter were supplemented by some kind of broad character assessment that described what coherence, openness and diversity mean for each of the major landscape types. In the absence of a stronger cultural component, it is therefore unclear to what extent such typologies are able to fully represent real landscapes if we view them in terms of the European Convention as areas '…..perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. The development of a more explicit cultural dimension to these typologies is appears as a high priority for future work.

Policy and stakeholder reviews

The ELCAI project investigated 14 European countries on the use of LCA in developing, implementing and monitoring policies. The study included the sectors of agriculture, tourism/recreation, spatial/rural development, housing/town planning, landscape policies, economy and cultural education. It was found that LCA has a different meaning for every country expressing different views on what qualities and elements of the landscape are considered as most relevant. While national authorities and experts are encouraged to maintain and further develop their on approach to LCA, international co-operation (including transfrontier activities) would benefit from a concise and generally accepted definition of LCA as put forward in the ELCAI project. Nevertheless, LCA is currently used as a mapping tool to design protected areas (e.g. Denmark, Flanders, Czech Republic) and also as part of the landscape management and spatial planning (England, Scotland, Wales, Germany and The Netherlands). It is also the basis for monitoring and evaluating features of the landscape (structure, morphology, diversity) in all sectors, especially in the tourism, agriculture and forestry sector the interest in applying LCA is growing (e.g. Monitoring /evaluation of agro-environmental programme in Austria). The policy review identified a need for harmonised definition and approaches which will help assess and compare the

landscape character at a range of scales throughout Europe. This harmonisation will in turn allow the development, implementation and monitoring of EU sectoral policies, and will result in a better integration of landscape consciousness in the various sectors.

Stakeholder contacts and the analysis of the WP2 questionnaire regarding policies and applications of Landscape Character Assessment showed that there is a broad interest in Landscape Character Assessment and in the ELCAI project. Although the importance of a general approach for Landscape Character Assessment was acknowledged, there was a clear interest for tailored methodologies that suit the stakeholders' own sphere of work. The overall achievement was that good stakeholder contacts at regional, national and international level could be established providing the basis for the ELCAI Stakeholder Workshop in June 2004 in Évora Portugal under the title "Putting Landscapes into Context – Perspectives for Research and Policy".

One of the key products of the ELCAI project is the Policy Brochure "Landscape Character Areas. Places for building a sustainable Europe" (Pérez-Soba and Wascher, 2005).

1 Landscape character: linking space and function

Dirk M. Wascher

1.1 Introduction

The Countryside Agency and Scottish Natural Heritage (2001) define Landscape Character as "a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse". When in comes to a meaningful definition of the term, the British view must be considered as relevant: the authorities of England, Wales and Scotland did not only inaugurate the term 'landscape character', they also succeeded in making it a widely applied policy tool for regional development, physical planning, land use, landscape and nature protection, sectoral resource planning and sustainability impact assessment.

Landscape scientists, planners, artists, representatives of economic sectors such as tourism, as well the interested wider public of other European and non-European countries, also make frequent use of the term landscape character: Any traveller reporting their impressions of a certain region – be it wilderness, countryside, or in proximity to a city – is likely to make use of the word 'character' when describing its most typical features, a special atmosphere, or when addressing the place's uniqueness. Similarly, when examining the appropriate expert literature in the field of landscape science, geography and spatial planning, the character of the landscape is likely to play a significant role as an assessment criteria, as a development objective or simply as a descriptive notion. The term's wide use seems to reflect our need to respond to the specialness and diversity of places around us. However, these popular usages of the term are also associated with some significant intellectual challenges:

- The implication that 'character' could basically be a ubiquitous phenomenon, in the sense that there is character in everyone, everything and everywhere, is in juxtaposition to the 'specialness' that 'landscape character' seeks to single out.
- If identifying 'character' is mainly a question of human perception and of the human capacity to perceive (e.g. the question "which level of detail can the human mind cope with?"), how much then does landscape character qualify for becoming associated with a scientifically stable reference framework and an accurate analytical tool for spatial planning, sustainable land use and environmental sciences?

The latter has indeed to be considered as a key challenge when developing landscape assessment techniques at the European level: Will 'Landscape Character Assessment' be able to provide substantially added value to what has already been developed in terms of tools and methods? How does it differ and how does it link up with what is already there? Who shall be its users?

The fact that British authorities have, for their contexts, answered these questions in a way that it has resulted in concrete policies and actions does not automatically mean that their approach also applies for other countries, or can stand as a model for the Europe-wide approach. Even if the term 'landscape character' is well established in other cultures and their relevant scientific and professional communities, there is still a considerable difference between using it in a descriptive and incidental way and using it as a concept that strategically can guide the interaction between research, policy development and policy implementation. The examples of terms from German nature conservation such as the 'Leitbild'-concept (Nohl 1994, 1995; Klug and Potschin 2005) or regional specification of the 'impact regulation' (Niedersächsisches Umweltministerium 1993) demonstrate that national approaches cannot easily be 'exported'.

Since Landscape Character Assessment is not widely established as a tool and concept, it seems worthwhile to first briefly track its historical roots as well as its current position within the recent research and policy development. This first chapter will further explore the spatial dimension of landscape character and how it links with landscape functions. Finally it will be explained how the ELCAI project implementation relates to the following chapters of this final report.

1.2 Historical roots and future perspectives

Despite or because of the European complexity, it is worthwhile to briefly examine the origins of landscape science as that can offer some insight on earlier approaches.

Poet Francesco Petrarca's ascendence to the peak of Mont Ventoux on April 26, 1336 is iconographically regarded as the beginning of a conscious perception of landscape. Almost 500 years after Petrarca, the explorer and pioneer of geosciences Alexander von Humboldt ascended a mountain in the South American Andes (Humboldt 1802). He did not come, as had Petrarca, to contemplate the world spiritually, but as a scientist carrying instruments (Lucht and Pachauri 2004).

Landscape as a concept is rooted in a wide range of both social and natural disciplines – including geographic, ecological and artistic approaches – dating back to the early 1800s. Other than in the English tradition where the term "landscape" is somewhat restricted to "scenery", the Dutch, Flemish and German meaning of the equivalent terms 'landschap' or 'Landschaft' is of wider scope, namely in the sense of the "total character of an Earth district" (von Humboldt 1807). Humboldt's definition of landscape became a guiding principle for many landscape scientist across

Europe and America when analysing landscapes in an integrated fashion – taking into account social, aesthetic, economic and environmental aspects (see Figure 1.2). Though already introduced in 1939 by Carl Troll in Germany, the discipline of "landscape ecology" became more commonly practised, established and developed after 1970. Zonneveld (2000), whose research on land ecology during the early 1960s had been inspired by soil and vegetation science (Braun-Blanquet and Tüxen 1943), also stressed the differences with the English term 'landscape ecology' when defining "Landschaftsökologie" which he considered as "the study of the relational system at the surface of the earth that can be recognised by its form and shape".

The aspect of recognition by an individual observer, is even more directly addressed by Steiner (1991): "Landscape is all the natural features such as fields, hills, forests, and water that distinguish one part of the surface of the earth from another part. Usually, a landscape is that portion of land or territory which the eye can comprehend in a single view, including all its natural characteristics". Such a visual interpretation stands in sharp contrast to the spatial landscape concepts that have been and are being developed by geography, remote sensing and landscape ecology.

This contradiction made it clear that a certain level of Cartesian tradition survived in the practical application of a science-oriented 'landscape ecology': at the project and research level, a relatively strong focus on ecological and environmental objectives appeared to overrule the socio-economic dimension and sometimes to be in conflict with human perceptions and preferences. In 1992, when the sustainable use of the world's environmental, human and economic resources became a key policy issue under Agenda 21, landscape scientists around the world felt reminded that their professional field offers methodological, integrative and operational tools that could help to put 'sustainability' onto the ground and into practice.

Especially since 1990 many authors stress the need for a more holistic approach to landscape analysis (Potschin 2002), which on the one hand developed into the request for more transdisciplinary approaches (see below) or on the other hand the Landscape Character Assessment approach (see Figure 1.1).

Already Naveh (1990) pointed out that the trans-disciplinary capacities of landscape ecology allow to:

- realise different fragmented perceptual views;
- deal with hierarchical social and spatial systems;
- apply an integrative and multidimensional approach; and
- conceive and shape the landscape accordingly.

Building upon the conceptual approaches of Messerli (1978, 'Regional Socio-Economic Ecological System'), Grossmann (1983) on 'Complex Human Ecosystems' and Haber (1990) on basic concepts of landscape ecology, Naveh has put forward the concept of the 'Total Human Ecosystem for Landscape' as a new symbiosis between human society and nature (Naveh and Liebermann 1993).

As the title of this Chapter implies, Landscape Character Assessment (LCA) is considered as the means for linking space to function, or as Cary Swanwick puts it, to "link places to people". The objective is hence to develop a tool that allows the user to judge whether and in which way changes affect principle landscape *functions*. According to Bastian (2000), a better understanding of landscape functions can be considered an important pre-requisite for transforming scientific knowledge to social categories. The ideas of landscape functions which had been used first by Neef (1966) in a geographical context and later developed by Haase (1978) and others prove as helpful approaches not only for the analysis and assessment of the landscape but also to draft landscape-ecological goals. Any review of existing approaches to classifying landscape functions demonstrates that – despite their overall holistic orientation – most of them are strongly rooted in the natural and bio-physical sciences, and that especially socio-economic functions are frequently under-represented. The recently emerging emphasis on societal goals (Millennium Ecosystem Assessment 2003; CEC 2005) points at a pressing demand for trans-disciplinary approaches with a strong spatial dimension. A successful operationalisation of landscape functions in support of such goals will largely depend on the ability to truly and full-heartedly bridge the gap between nature and human society.

1.3 The ELCAI project implementation

Examining the origin and use of 'landscape character' or 'Landscape Character Assessment' throughout all 14 countries participating in ELCAI – let alone throughout the EU-25 or the whole of the 55 European nations – was, somewhat fortunately, not the task of this project. Thus, the ELCAI project is mainly concerned with the way that the participating countries make and made use of landscape character maps, typologies and indicators and how these national approaches relate to European initiatives.

At the European level, a number of policy initiatives have underlined the special role of landscape in the future environmental and social-economic development:

- the Pan-European Biological and Landscape Diversity Strategy (Council of Europe, UNEP and ECNC 1995);
- the European Landscape Convention (Council of Europe 2000);
- the European Commission's reform of the Common Agricultural Policy towards rural development and more sustainable principles (Agenda 2000); and
- the Guiding Principles for Sustainable Spatial Development adopted by the European Conference of Ministers responsible for Regional Planning (CEMAT 2005);

All of them signal the need for new conceptual and procedural approaches with clear implications for the management, planning and assessment of landscapes at the European level. In response to this need, the expert network Landscape Europe launched the European Landscape Character Assessment Initiative (ELCAI) as an

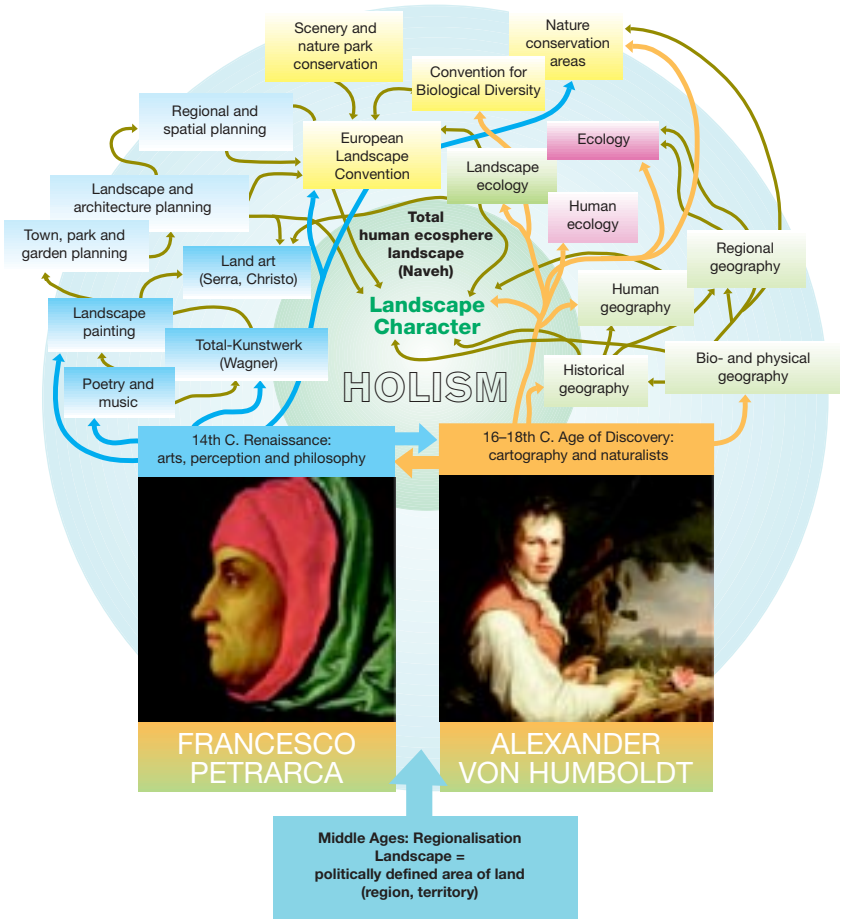


FIGURE 1.1. Historical origins of landscape research in relation to other scientific and policy fields with special attention to the holistic dimension. (Wascher 2005, modified according to Antrop 2000 and Schenk 2002).

EU project. ELCAI's objective was to review the state-of-the-art Landscape Character Assessment techniques among its 14 participating countries and to analyse the role of policies and stakeholders at various levels. Building upon the project results, the following paragraphs highlight some of the key implications of the above processes from the viewpoint of national and European policy development.

By recognising that landscape assessment can no longer focus only on outstanding and extremely picturesque examples, the European Landscape Convention initiated what must be considered a paradigm shift in European policy development: Article 2 states that the Convention applies to "the entire territory [of the Parties] and covers natural, rural, urban and peri-urban areas". The Convention's all-encompassing scope is echoed by Giulio Carlo Argan, one of the great scholars of art history, who stated to the Italian Senate in 1985 (Isman 2002) that "landscape is the undeniable piece of artistic and cultural property and the foundation of any nation", underscoring that "the aesthetic aspect of the environment is the result and not the precondition or cause of good policy, a good economy and a good administration of the environment."

When comparing Argan's aesthetic principles for landscapes with the vision laid down in the EU Strategy for Sustainable Development (CEC 2001), the resemblance is striking: "Sustainable development offers the European Union a positive long-term vision of a society that is more prosperous and more just, and which promises a cleaner, safer, healthier environment – a society which delivers a better quality of life for us, for our children, and for our grandchildren. Achieving this in practice requires that economic growth supports social progress and respects the environment, that social policy underpins economic performance, and that environmental policy is cost-effective."

Directly in line with the Strategy on Sustainable Development is the Directive on Impact Assessment (CEC 2002), which requests the EU to assess all Community policies regarding their impact on sustainability. The newly arising European requirements are also reflected in the recent work of the European Environment Agency which has included landscape indicators and typologies as part of their string of agri-environmental indicators (IRENA, EEA 2004). Another field of applications is the EEA's increasing work on land use and ecosystem accounts on the basis of CORINE land cover changes between 1990 and 1999.

Targeting these European requirements the ELCAI project asked participants to formulate national specifications for the European Landscape Typology and Map (Mücher *et al*. 2003) towards becoming a commonly accepted reference for future European policy implementation in the field of rural development, agri-

environmental assessment, sustainability impact assessment and biodiversity conservation. As a first result, the current version of the map (LANMAP2) has become a key reference for the Integrated Project SENSOR[1] as part of the 6th Framework Programme. SENSOR is designed to develop a Sustainable Impact Assessment Tool (SIAT) that allows end-users to analyse European-wide policy scenarios for land use trends and changes (2015–2025) regarding their likely economic, social and environmental impacts on *landscape functions* at the regional level.

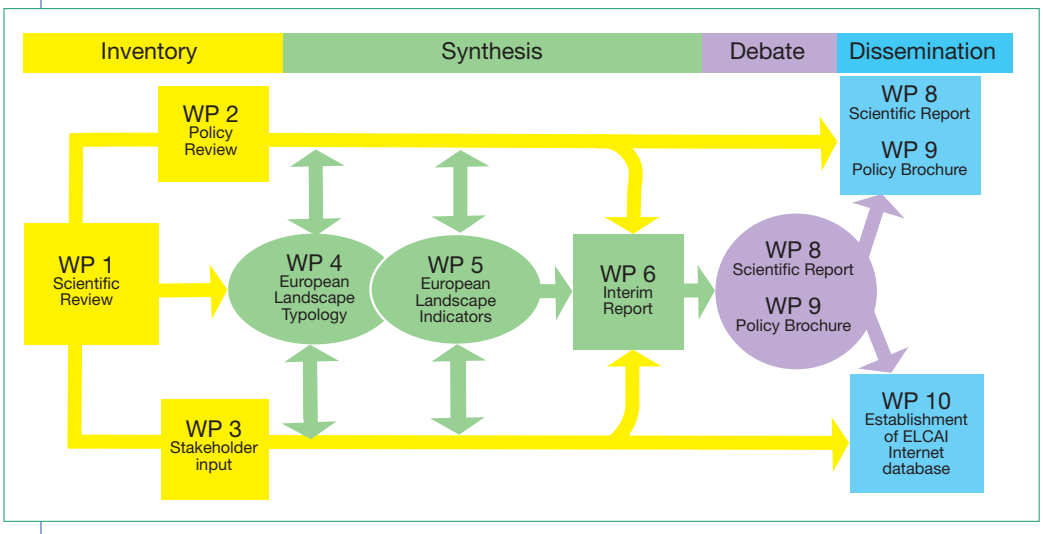
In the light of increasing landscape changes, many national agencies have developed sophisticated Landscape Character Assessment tools that are scientifically sound, region-specific and stakeholder-oriented – qualities that are considered as key issues for the future implementation of the EU policy and research agenda as well. The contributions compiled in this report are meant to provide the reader with a general but nevertheless insightful view on the rapidly evolving field of Landscape Character Assessment at the interface between European policy and regional identity.

The structural components of the report reflects in principle the technical implementation plan of the ELCAI project as conceptually presented in the Figure 1.2. The sequence of these components, however, has been re-arranged in the following way:

- Chapter 2 provides an overview on the existing landscape mapping activities and products both at the European and national level, thereby introducing the 51 typologies and maps that form the basis of the following analytical reviews.
- The so-called 'scientific review' is being presented in Chapter 3, providing an in-depth analytical comparison between the national and European examples on the basis of specially developed criteria.
- Making use of the findings in the scientific review, Chapter 4 highlights some of the geo-spatial aspects when comparing selected landscape typologies in the European as well as in the regional/cross-boundary context.
- Chapter 5 explores the role of landscape character indicators in the light of policy requirements and landscape typologies;
- Chapters 6 presents the results of an inventory among policy and other stakeholders with regard to the role of Landscape Character Assessment; and
- Chapter 7 casts a light on current applications as well as possible future perspectives of Landscape Character Assessment tools.

As mentioned, the methodology included surveys among project partners as well as input by external individuals and organisations.

FIGURE 1.2. ELCAI project implementation plan.



[1] SENSOR = Sustainability Impact Assessment: Tools for Environmental, Social and Economic Effects of Multifunctional Land Use in European Regions; see: http://www.sensor-ip.org

2 Recent developments in mapping Europe's landscapes

Dirk Wascher, Geoff Groom, Sander Mücher and Annegret Kindler

2.1 Introduction

Landscapes are shaped by a combination of natural and cultural forces. Natural factors such as climate, bedrock, ice periods, volcanism, relief, water availability, soil fertility and vegetation have been part of long-lasting evolutionary processes. Most natural factors are continously exposed to and transformed by human intervention in the form of agriculture, transhumance, forestry, rural policies, water management, settlements, and other. In the case of European landscapes, the degree of human influence has been particulary strong and led to striking characteristics. Both natural and cultural features need hence to be considered when developing a framework for a European landscape classification. Although all of the above listed factors contribute to the character of a landscape, it is the climate and other abiotic aspects that allow broad distinctions of land use and landscape at the European level.

The previous chapter presented some principles for the development of European Landscape Character Assessment tools. Classification is one aspect of this process and will contribute towards establishing a common code of understanding when talking about landscape types in Europe. This process can be compared to the work that has been undertaken at the level of the European Commission and the European Environment Agency to create a European wide classification of habitat types. When EU's CORINE Programme began in 1985 it showed that for the description of European biotopes there was a reasonable agreement on species terms (though also in this field progress was necessary), but that there was a large variety and inconsistency in the terminology regarding habitat types. A comparison between and within countries showed that different phyto-sociological schools provided different approaches in classifying habitats. As a result, one and the same habitat type was carrying different names or – more frequently – was sorted into different categories. It took the European Commission more than 10 years to reach an initial internal consensus, with a complete European expert agreement still being out of sight.

While the example of the habitat classification helps to illustrate the issue, it must be stressed that there are considerable differences between habitats and landscapes:

- in contrast to habitat, landscape typologies are not exclusively based on scientific analysis but incorporate large degrees of traditional/common knowledge and perception;
- because of the integrative character of the landscape concept, it comprises area references from other disciplines;
- landscape typologies have not drawn the same degree of attention from the classical scientific world since they find their practical applications at the national and regional level, e.g. in national and regional planning.
- international landscape classification approaches are still at a relatively early stage, opening the possibility for establishing systems on the base of actual user needs, such as those identified in the previous chapter;
- apart from the case of small-scale information on habitats, landscape mapping holds greater potential for generalisation, thereby facilitating future mapping procedures;
- landscape description is based on a much wider range of criteria than habitat description.

In order to get a good understanding about the type of landscape units that should be recognised within a European approach, it is useful to take a look at the landscape typologies and mapping projects that have been developed until today.

2.2 The biogeographic context

In order to determine the type and degree of natural influences on landscape character it is useful to first examine Europe's 'biogeographic' context. Because of the critical role of biogeographic 'driving forces' on human land use activities and hence on the character of landscapes, biogeographic classes must be considered as a key criterion for a European-wide approach to landscape classification and mapping.

Each climate type and their major subdivisions has a number of characteristic plant and animal species and communities that have evolved so that they are adapted to the range of environmental factors in them; such characteristic biotic communities occupying an extensive area are called biomes. The distinctions between biomes are not necessarily related to the taxonomic classification of the organisms they contain, but rather to the life-form (the form, structure, habits, and the type of life history of the organisms in response to its environment) of their plants and animals (Cox and Moore 1973). This concept of life-form was first put forward by the Danish botanist Christen Raunkiaer in 1903. Terrestrial biomes are frequently distinguished by the plants that dominate them, e.g. tundra (mosses, lichens, dwarf-shrubs, sedges), taiga (boreal coniferous forests) or tropical rain forests.

Traditionally, plant geographers were concerned with explaining the distribution of different types of plants in physiological terms, and some of the basic mechanisms involved in cold tolerance and drought resistance have been known for decades (Prentice *et al.* 1992). For example, Köppen's scheme (1918) was intended as a classification of climates, although its boundaries were

TABLE 2.1. Biogeographic classifications and concepts based on ecosystem approaches. (Wascher, 2004; after Grabherr and Koijma 1993).

Year	Initiative
1898	V.V. Dokuchaev: proposed a concept of soil as a functional product of climate, parent material, relief, organism, and time
1903	C. Raunkiaer: suggests the distinction of life-forms
1918	W. Köppen: classfication of world climate regions
1941	H. Jenny: factors of soil formation
1951	J. Major: vegetation and soil to constitute an inseparable complex which may be termed a 'phytogeocoenosis', emphasising a causal relation between vegetation and environment
1916	F.E. Clements: climax vegetation (plant succession)
1929	G.E. Nichols: plant associations and their formations
1937	W.E.D. Halliday: forest classification for Canada
1950	E.L. Braun: vegetation at the formation rank mainly considered as a product of climate and represented as a climatic climax
1935	A. Tanseley: coins the notion of 'ecosystem' for a complex of natural systems
1945	V.N. Sukachev: coins the term 'biogeocoensis' (comparable, but only at community level)
1973	H. Ellenberg: ecosystem classification of the world, addressing primary productivity, trophic characteristics, macroclimate, soil character – mainly based on vegetation formation
1975	Udvardy: biogeographic provinces
1976	H. Walter: criticises Ellenberg as being central European, suggesting the biome system as fundamental unit (e.g. orobiomes = mountain systems) to which zonal vegetation can be assigned
1960	V.J. Krajina: biogeoclimatic ecosystem classification integrated climate, vegetation and soil characteristics at two levels (region + site specific), highest biogeoclimatic formation comparable to Clements
1947	L.R. Holdrige: Life Zone Model (on the basis of climatic variable-degrees mean annual bio-temperature)
1956	H. Lieth: correlation between average climate levels and vegetation formations
1970	R.H. Whittaker: correlating broad regional vegetation at the formation level directly with environment, particular climate
1984	R.B.H. Bunce: development of a European land classification
1989	Bailey: eco-regions of the world
1991	E.O. Box: plant functional types were assigned climatic tolerances
1992	European Commission: biogeographic map for the Habitats Directive (EEC/43/92)
1996	Rivas-Martinez and Penas: biogeographic map of Europe
1999	Marco Painho: digital map of European ecological regions (commissioned by the European Environment Agency)
2004	Metzger *et al.*: environmental classification of Europe

chosen to coincide approximately with vegetation boundaries and are expressed in terms of aspects of climate (particular seasonality) that are relevant to plants. On the other hand, Holdrige's approach related potential natural vegetation to climate, although its boundaries reflect areas of consistent climate that is defined by annual precipitation and growing season temperatures.

In recognition of the potential value of a detailed and internationally agreed-upon biogeographic map for environmental reporting on issues such as biodiversity and landscapes, the European Environment Agency initiated the development of a Digital Map of European Ecological Regions (Map 2.1). The map is based on two recently digitised maps, namely the Map of Natural Vegetation of Europe with polygons at a scale of 1:2.5 million (Bohn *et al.* 2000), derived from an analysis of soils and vegetation maps validated by an expert review, and the European Land Classification (Bunce *et al.* 1984; 1996) with a grid-cell resolution of 0.5° x 0.5° (about 2000 sqkm), derived from a cluster analysis of European-wide climate data. The methodology that has been applied resulted in a division of Europe into 69 ecological reporting regions. At this level the correlation between the two source maps is relatively high and the number of classes manageable with regard to the objectives for making the map. The map was produced by ISEGI (Instituto Superior Estatística e Gestão de Informacão, Lisbon). It was finalised in 2000 in co-ordination with WWF (World Wide Fund for Nature) for their world conservation region project (Painho and Augusto 2001).

However, the examples noted above, such as the DMEER map, have been based on relatively coarse climate data. With the arrival of new high spatial resolution climate data sets, it became possible to develop more detailed region-specific approaches such as the Environmental Stratification of Europe (EnS, Map 2.2) of Metzger *et al.* (2005). Based on a 10'x10' resolution (approximately 16x16 km) climate dataset developed by the Climate Research Unit at the University of East Anglia, thirty-year average values were calculated and subsequently re-sampled to a 1km^2 grid. In addition, the global digital elevation model of the US Geological Survey, altitude and slope were included in the environmental classification as surrogates for geomorphology. The following steps (Metzger *et al.* 2005) in the classification and mapping were:

- The first three principle components, describing 88% of variance in the parameters were clustered using the ISODATA clustering routine. To ensure northern Europe, which is more homogeneous than southern Europe, received its share of classes northern and southern Europe were split by creating two classes

on only the climate parameters. Subsequently the clustering routine was run on the complete PCA for northern and southern Europe.

- In 14 cases a class was split in two because it spanned two distant biogeographic zones, i.e. there were classes occurring in both Scotland and the Adriatic. As a result there are 84 EnS classes.
- Based on the 84 EnSs classes, 13 Environmental Zones were distinguished. For this step, firstly each class was assigned to one of six biogeographic regions. Secondly, based on this first designation, the classes were grouped in 13 Environmental Zones, based on the mean first principle component value of the class.

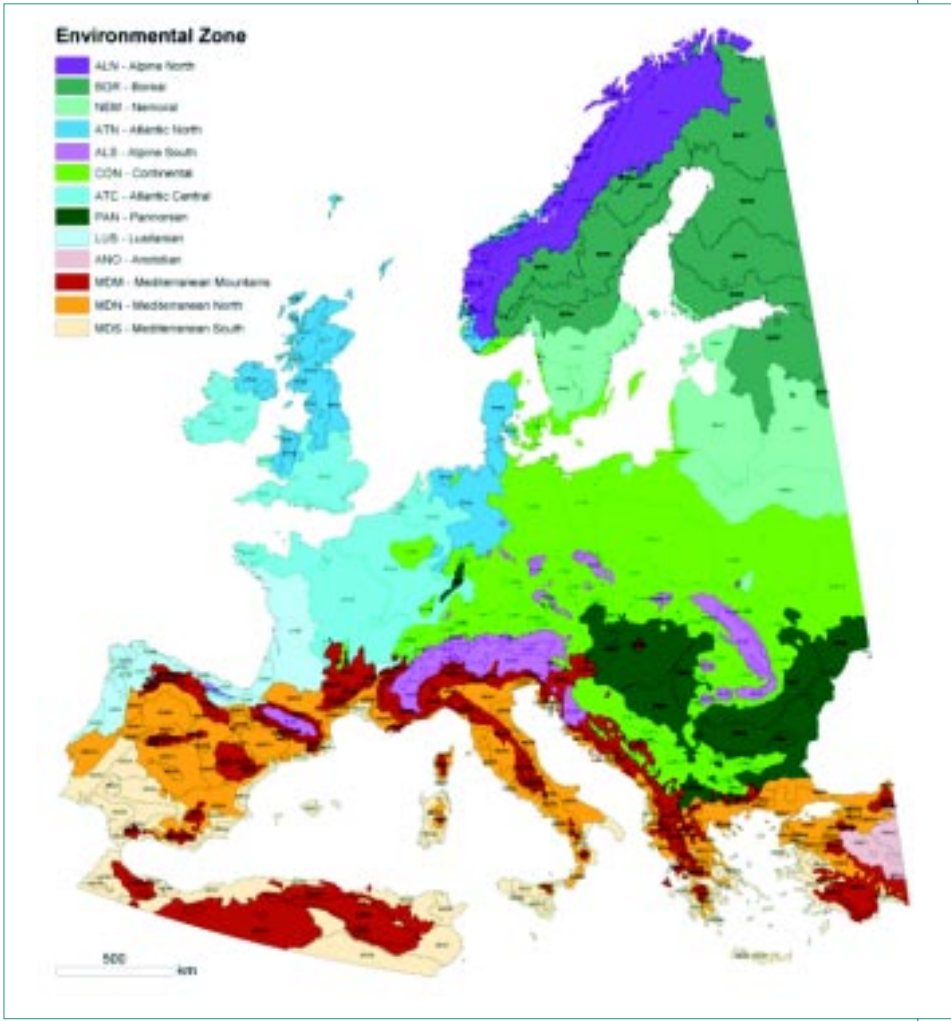
Table 2.2 shows that there the correlation between the Environmental Classification and other relevant maps, such as the Potential Natural Vegetation map (Bohn *et al.*

TABLE 2.2. Correlations between the mean first principal component per EnC class and other available ecological data sets, using Pearson's correlations coefficient at the 0.01 level.

Dataset	R^2 of the regression	Pearson's correlation coefficient
Potential Natural Vegetation	0.85	0.920
Quercus species distribution	0.72	-848.000
FAO DSMW, all soil types	0.59	0.771
FAO Agro-Ecological Zones	0.45	0.671
FAO DSMW, main soil group	0.43	0.659
PELCOM land cover	0.34	0.585
CORINE land cover	0.23	0.477

MAP 2.1. The EEA-ETC/NC map for Ecological Regions in Europe (DMEER).
(Painho and Augusto 2001)

MAP 2.2. The Environmental Stratification of Europe in 13 Environmental Zones and 84 Classes. (Metzger *et al.* 2005)



2000), Quercus species of the Atlas Flora Europea (Jalas and Suominen 1976), different aggregation levels of the FAO soil map of the world and agro-ecological zones, PELCOM (Mücher *et al.* 2001) and CORINE land cover (CEC 1994).

2.3 International landscape maps

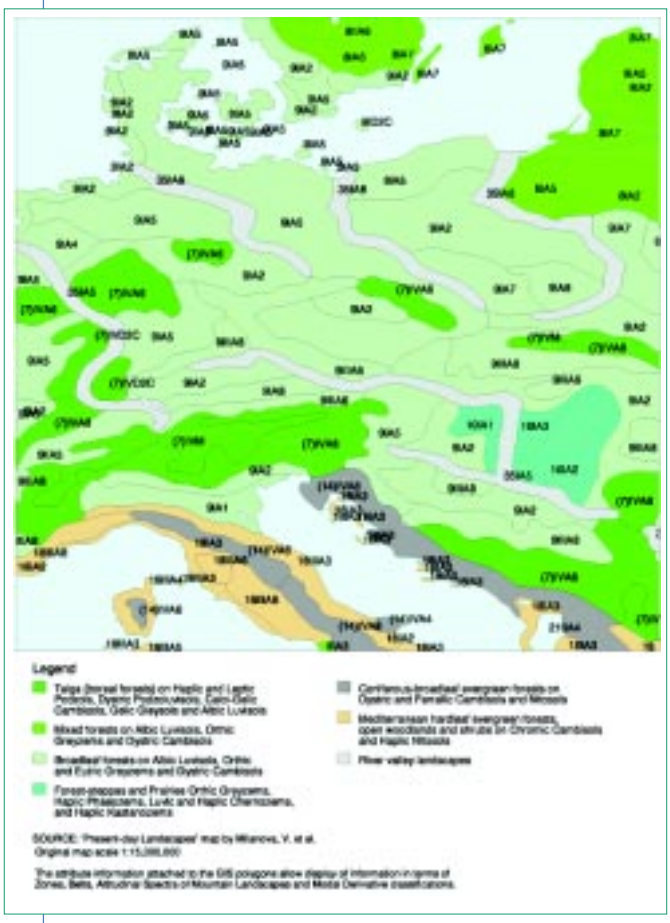
The different regional and national landscape typologies form a patchwork of classification models, which are conceptually rather incompatible at the international level. This is one of the reasons that classification models also started to evolve at the international level. Most of the studies presented in the previous section are exclusively focused on climatic/bio-physical characteristics, and have been carried out at the global scale; as a result, the European continent is dealt with in a broad approach. While these maps can provide valuable information for the analysis of large-scale conditions, they proved to be inadequate for the purpose of identifying landscapes at the European scale.

Two interesting approaches to a classification of global landscapes have been put forward: a Russian approach under the title 'World Map of Present-Day Landscapes' developed by Milanova *et al.* (1993) and the more recent American attempt 'Anthropic Landscapes Map' by the USDA Natural Resources Conservation Service. Especially important from the European perspective is the work undertaken by Meeus (1993) which formed the basis of the landscape map in the first pan-European environmental report of the European Environment Agency, the Dobříš report (Stanners and Bourdeau 1995). All three maps and typology will be briefly reviewed in the following sections.

2.3.1 World Map of Present-Day Landscapes

In October 1990, the United Nations Environment Programme (UNEP) and the Centre for International Projects (CIP) of the USSR State Committee for Environmental Protection signed a Memorandum of Understanding to assess and map the present status of the world's landscape. The project was co-ordinated by E.V. Milanova at the Moscow State University. According to the objectives of this assessment:

> *'present-day landscapes (PDLs) are specific units of land surface characterised by a structurally organised combination of natural and economic components, whose close interaction gives birth to spatially distinct territorial systems in a dynamic equilibrium'*
>
> (Milanova *et al.* (1993)

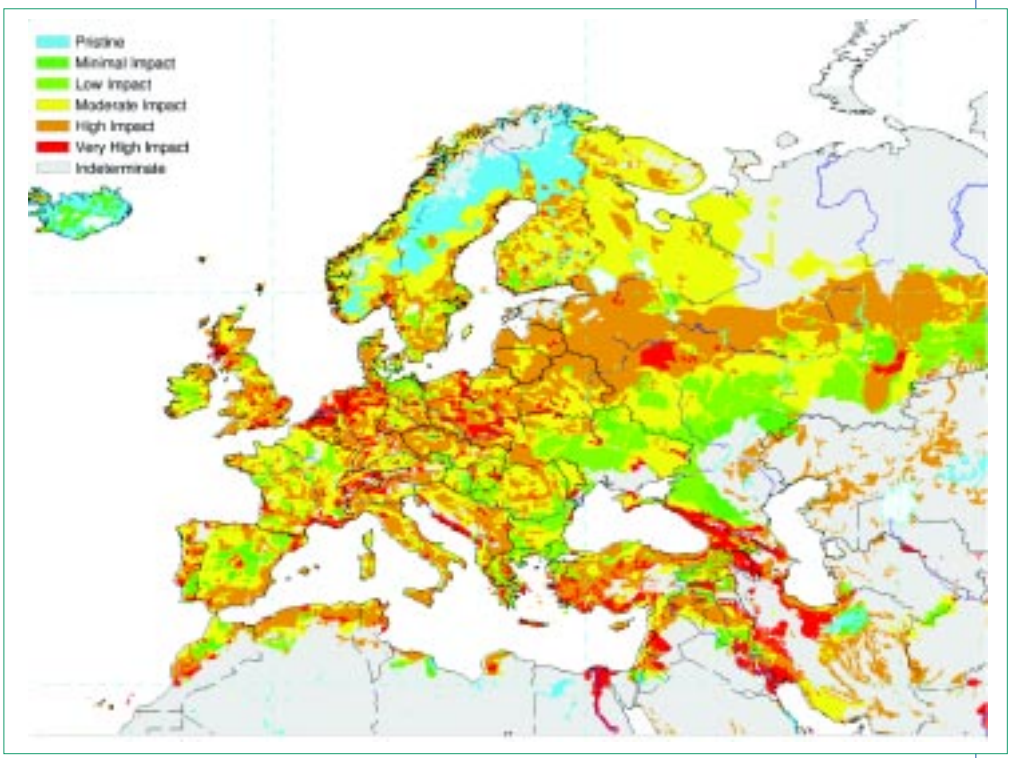


MAP 2.3. World Map of Present-Day Landscapes, excerpt.
(Source: Milanova, 1993)

The UNEP world map has a scale of 1:15 million and is based two other maps: (1) Geographical Belts and Zonal Types of Landscapes of the World, 1988 (Moscow GUGK SSSR, 1:15,000,000); and (2) Land Use Types of the World, 1986 (Moscow GUGK SSSR, 1:15,000,000). Information from these sources was supplemented with data from regional cartographic, remote sensing and ground-truth field survey sources. The belts identified by the first map are characterised by a range of natural processes, zonal patterns and sets of natural landscapes, with more emphasis on 'geographical' aspects rather than 'climate'. The sub-polar, temperate and sub-tropical belts identified for (Western) Europe comprise eight natural landscape units and two intra-zonal landscapes, all together more than 150 delineated types. Each landscape unit is described by a code system based on its natural and anthropogenic characteristics, specifically on the type of natural landscape zone, topography ('orographic class'), degree of transformation due to human impact, trends and current land use. The UNEP world map is digitised and the data can be managed with GIS.

The UNEP's world map of present-day landscapes is rather coarse in scale, delineation and attribute definition. The mapping units are closely related to the FAO soil map of the world, characterised by climatic aspects, soils and by potential vegetation, leaving concrete landscape types unidentified. The map's river landscapes are depicted – due to the scale – as wide corridors which do not correspond with the real landscape aspects of these azonal and – over the length of the river – non-uniform landscape types. According to the map's generalising coding system, the Alps are, for instance, represented as a unit of undisturbed mountains, which can only be true for the remote and highest peaks.

MAP 2.4. World Map of Anthropic Systems, excerpt.
(Source: Natural Resources Conservation Service, USDA, Washington DC, USA)



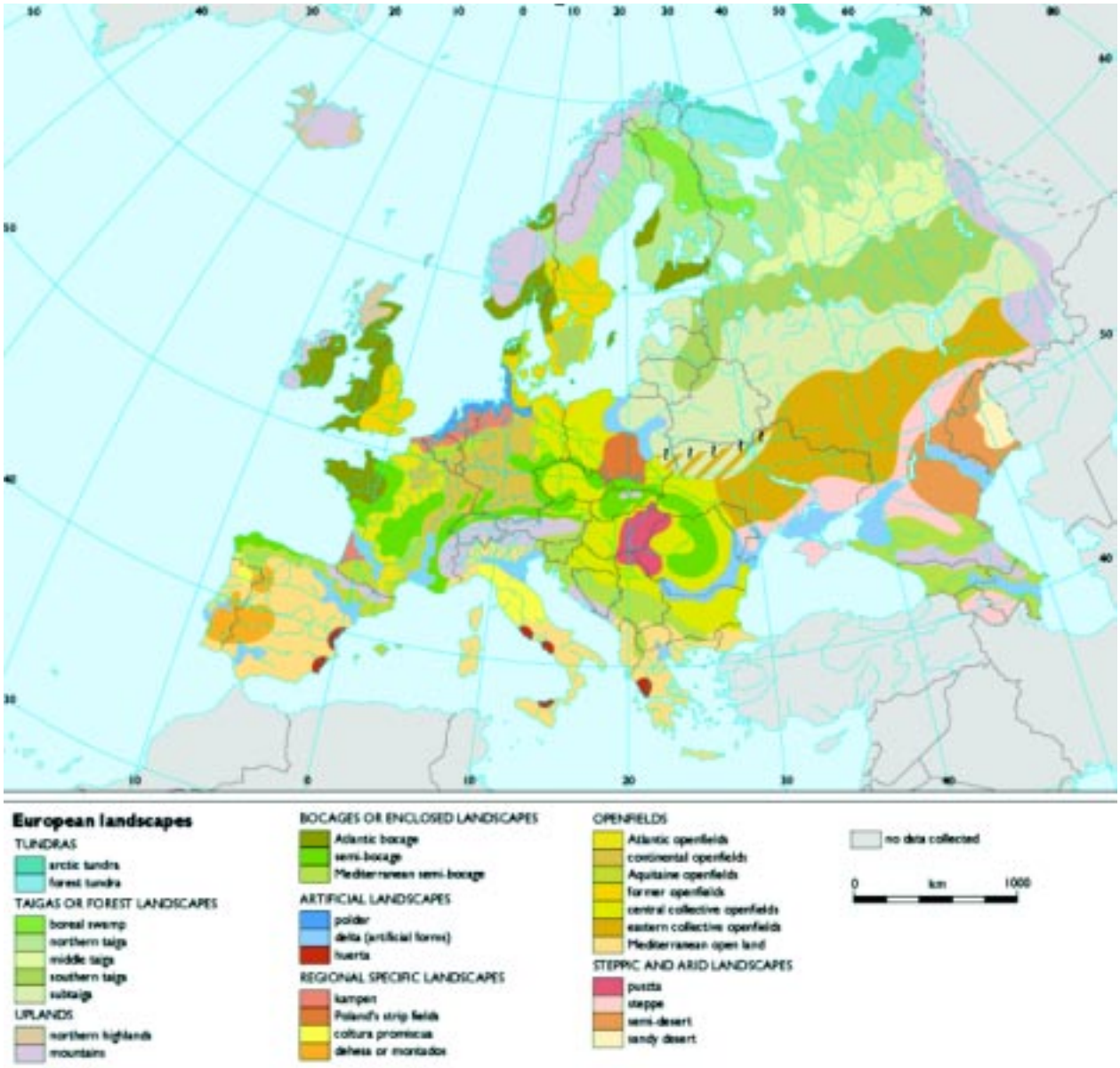
2.3.2 The Global Anthropic Systems Map

In 2001, the Natural Resources Conservation Service of the United States Department of Agriculture (USDA) had launched a study to obtain a preliminary assessment of global land resources and specifically the geographic areas where ecosystems have been impacted. The purpose of this analysis was to portray different manifestations of anthropic impacts on land. Though focussing on agri-ecosystems, the American study addresses key aspects of human impacts on landscapes such as agriculture, forestry, recreational uses, mining, and infrastructure.

The methodological approach for developing the Global Anthropic Systems Map is based on the four key variables soil, climate, management system, and time. The assessment of land quality (Eswaran *et al.* 1999) combines the soil and climatic variables and how they influence agricultural productivity. Socioeconomic and political factors are not considered in the quality assessment. The study makes use of population density as a default variable related to the effects of management and time, considered as appropriate for a global or regional assessment. As the intent was to demonstrate broad geographic patterns, population density serves as the proxy indicator for the impacts of land use during a long time frame.

The analysis is necessarily empirical because there are few methods to assess and monitor quality of agroecosystems. Consequently, there are no databases and the assessment has to be made using judgement and assumed relationships between population pressure and inherent quality of land. A digital global land quality map was overlain on an interpolated population density map of the world. Details of the method are provided in the larger study are in press (Eswaran and Reich 2005).

MAP 2.5. European landscape typology from J. Meeus. (Stanners and Bordeau 1995)



2.3.3 The Dobríš Landscape Map by Meeus

In the 1990s Meeus developed a map of the European landscapes on the scale of 1:25 million. He identified 30 landscapes at a continental scale. This pan-European landscape typology is based on the integration of landscape formation factors like land form, soil, climate, regional culture, management and history. "The typology proposed is an attempt to generalise the characteristics of landscapes and to formulate a basic framework for assessing how natural and anthropogenic factors affect the development of the environment" (Meeus 1995, p. 58). For a whole continent the interrelations between the cultural and natural heritage shall be considered. Furthermore, the typology was meant to become an instrument for setting European priorities in the context of a sustainable development of natural resources.

In the absence of an accepted system of landscape classification on a continental scale, Meeus proposed a multi-dimensional typology. In his opinion, the interaction of human activities and natural systems on the one hand and the resulting scenery of landscape on the other hand, are the most important dimensions. By means of geological, ecological, agricultural, silvicultural and visual criteria, his intention was to identify 'major landscapes' in Europe at a high level of abstraction. Meeus applied the following six selection criteria (Meeus 1995, p.61–62):

1. main land forms characterising geological and climatic zones;
2. economic potential of land use and landscape;
3. characteristics based on a combination of ecologically sound process and sustainable use of natural resources;
4. importance of extensively managed areas for the experience of nature and wildlife;
5. regionally specific settlement patterns, ancient field systems, old trees, terraces and vernacular architecture as indicators of local inhabitant's need to express their cultural heritage; and
6. scenic quality and visual characteristics of the region itself.

Based on the existing national typologies and the six selection criteria Meeus identified thirty landscape types grouped into eight categories. The map of the European landscape types represented in Map 2.5 shows the spatial extent and pattern of the single landscape types.

In support to the map, each European landscape type is described with respect to the growing conditions, vegetation, scenery and dynamics.

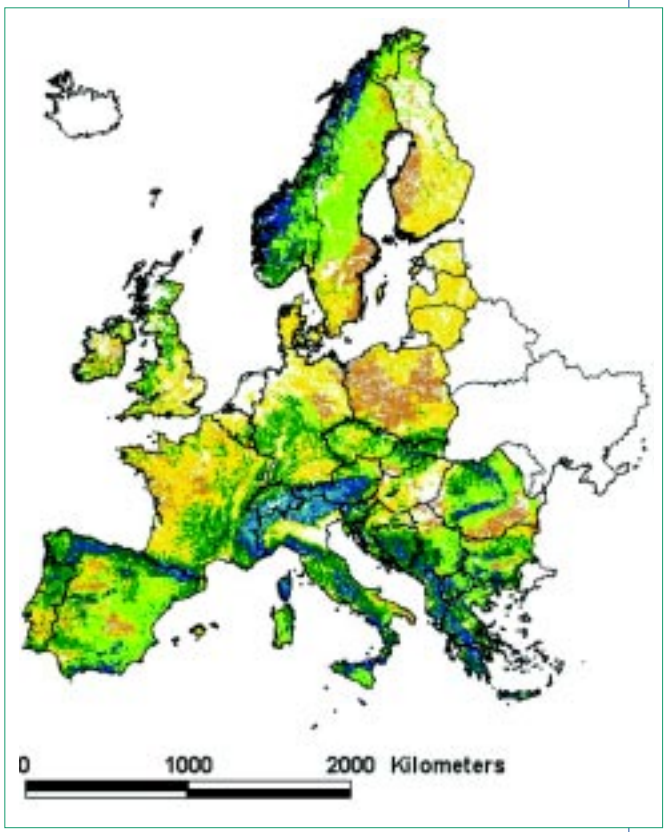
Just like Kostrowicki (1984), Meeus had defined and analysed agricultural landscape types in earlier studies (1993). The typology and map of landscape for whole Europe, however, is mainly based on the analysis of the different existing national typologies, maps and the scientific expertise. The map gives an overview over the main landscapes in Europe. On the one hand determined by the small scale of 1:25 million and the available input information a more detailed classification with a higher spatial accuracy could not be expected. It is interesting that in spite of the rather coarse typology, regionally specific landscapes are the main landscape types. Meeus integrated these regionally specific landscapes because they describe and emphasise not only the specific features of the individual elements and the relations between them but also they are non-repeatable in time and space. The differentiation of zonal or typological landscapes is based on more general features of components and relationships which makes one landscape different from another. These landscapes can occur repeatedly in space and time.

Each landscape type is cartographical represented by means of a certain colour without a borderline. For orientation purposes the map contains the national borders and the main rivers. Meeus' landscape typology and map was the first approach towards a European landscape map of its kind and still stimulates discussions about the actual appearance of landscapes and their development in a European-wide context.

2.3.4 ENVIP-Nature (landscape typology and indicators for nature protection)

This ongoing study aims at supporting the implementation of Natura 2000 sites by contributing methods to facilitate and harmonise the reporting procedure of the Member states. A standard set of criteria, indicators and methods are defined utilising Earth Observation data (SPOT 4, LANDSAT-TM, and IRS-1C) and Geographic Information System for the characterisation and assessment of European natural and semi-natural terrestrial landscapes with special

MAP 2.6. ENVIP Nature Map on Landscape Types. (JRC 2002)



emphasis on biodiversity assessment and nature protection. The main focus of the study is on the calculation of spatial indices characterising the structure and composition of landscapes. The methodology uses a six-level hierarchy that includes landscape aggregates (10–300 km^2) and landscape units (2–50 km^2. The latter are characterised by borders that are dynamic over time, the human influence and the mosaic of landscape elements (0.01–5 km^2). Landscape aggregates are characterised by borders that are stable. The method is tested in five pilot areas which comprise five different biogeographic regions (Alpine, Atlantic, Boreal, Continental and Mediterranean). Besides the elaboration of a harmonised landscape typology system the main focus of the study is on the calculation of spatial indices characterising the structure and composition of landscapes. It is evaluated to which extent these indicators can describe human induced processes, which lead to deterioration, losses and the fragmentation of habitats, interruption of ecological corridors and reduction of the variety of landscapes.

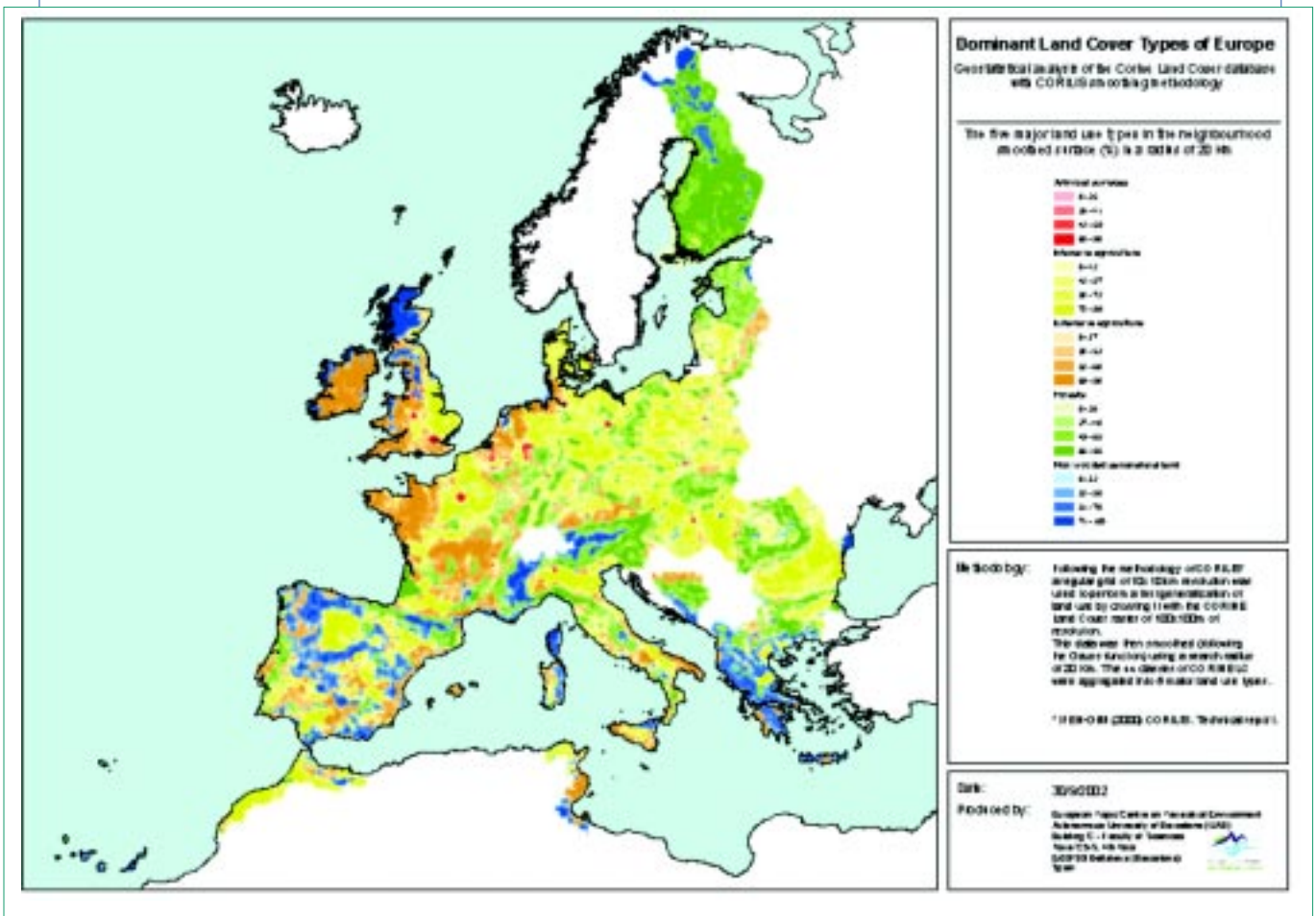
This study is framed within the ENVIP-Nature component of the EUROLANDSCAPE Project of the Joint Research Centre/Space Applications Institute institutional activities of the Fifth framework Programme of the European Commission.

This EU-financed project aims at supporting the implementation of Natura 2000 sites by contributing methods to facilitate and harmonise the reporting procedure of the Member states.

2.3.5 EEA Dominant Landscape Types

This is a data layer produced in relation to the development of Land and Ecosystem Account (LEAC) by the EEA and Eurostat in 2003. The Dominant Landscape Types are defined by reclassification of the smoothed values of CORILIS analysis (neighbourhood analysis of the major land cover types). Different allocation rules are used for the five main sea catchment domains (Baltic, North Sea, Atlantic, Mediterranean, and Black Sea). This procedure results in seven level-1 Dominant Landscape Types. These are further divided into 21 level-2 types based on elevation (lowland, upland, and mountain). The seven lowland level-2 types are each sub-divided into three level-3 types on the basis of their coastal (low coastal, high coastal, inland) characteristic. The mapping is made for a 3x3 km grid.

MAP 2.7. Dominant Landscape Types of Europe. (EEA-ETC Terrestrial Environment 2002)



2.4 National and regional maps and typologies

2.4.1 Introduction

Some national approaches to landscape mapping are building upon a large amount of scientific expertise and can reflect a long history of landscape ecology or geography. The methodologies can differ substantially, depending on the cultural history, the role and orientation of regional planning and of course on the physical characteristics of a country. For example, in Scandinavia, the Nordic Council of Ministers has established biogeographical regions along climatic criteria, arriving at five large zones (glaciers, alpine, boreal, boreo-nemoral, and nemoral) with 76 sub-zones. These sub-zones are based on topography, vegetation cover (forest types) and regional identity. On the other hand, biogeographic terms do not appear in the English approach which identifies 'four component types of the British countryside' deriving from grouping 32 land classes according to environmental characteristics such as geology, altitude and climate (Bunce *et al.* 1996). The four types are uplands, marginal uplands, pastoral and arable landscapes, clearly emphasising the strong links between the perception of English landscapes and a land-use history of more agricultural nature than in Scandinavia. Land use does not play a role for both the Dutch *regio-indeling* (regional division) and the German *Naturräumliche Gliederung* (natural division) which are based upon geo-morphologic characteristics, and show cartographically and terminologically harmonised results.

In the following sections, this introduction will highlight a few examples for landscape mapping among the national approaches that are going to presented and examined in this report.

United Kingdom
The Countryside Agency and Scottish Natural Heritage (2001) define Landscape Character as "a distinct,

MAP 2.8. Landscape Character Areas of England.
(Source: English Nature, 1998)

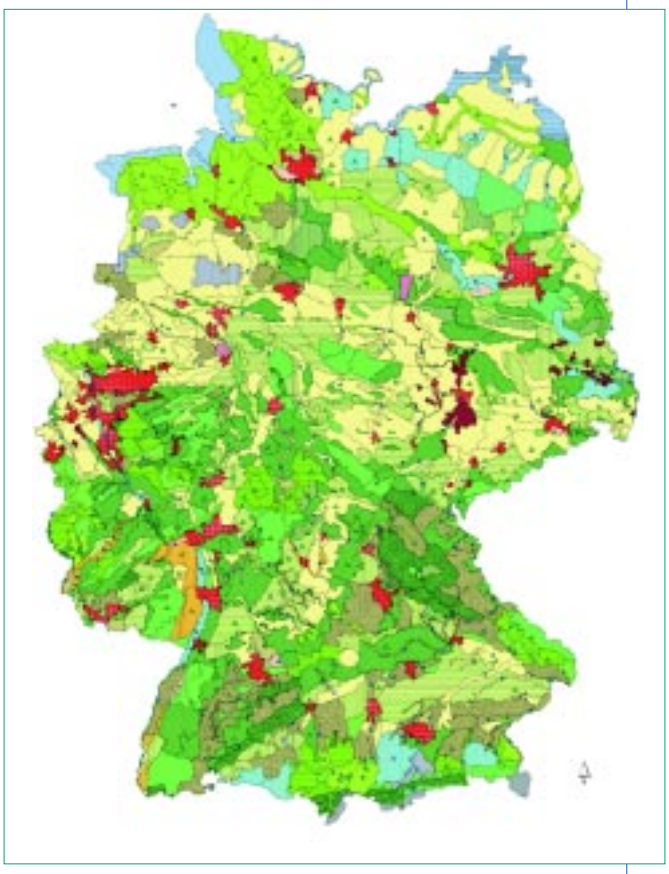
recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse". As part of the 'Natural Area Programme', English Nature has identified and mapped distinct units – so-called 'natural areas'. The boundaries of these areas do not follow administrative boundaries, but are defined by their wildlife and natural features, their land use and human history. Ninety-nine Natural Areas have been identified within the England territory and for each area exists a description of its ecological character (Map 2.8). English Nature developed the Natural Areas map through multi-layer analysis of environmental information in map format (e.g. climate, topography, soils, land cover, hydrology, etc) with the help of a Geographic Information System (GIS). The result of this analysis has been validated through a comprehensive consolidation process with regional experts who checked boundaries and compared the results to historical maps. The Countryside Agency "(since April 2005 integrated into the umbrella organisation 'Natural England') that was concerned with the whole of the English countryside applied a comprehensive analysis to identify 181 'Landscape Character Areas' as integrated components within the natural areas. It can be concluded that the identification of landscapes builds upon basic information on ecological regions. 'The landscape character map of England' is conceptually part of 'building blocks' for landscape and nature conservation to form a single, easily understood framework. Local authorities and others working at a regional or county level are invited to use the framework as a useful bridge between national policies and programmes and their own interpretations of needs and demands. The map is supposed to 'deliver national consistency by serving as a starting point for developing more informed policies to help English agencies shape the landscape, wildlife and natural features of the future' (Somper 2000).

Germany

Within the scope of this Research and Development Project (F+E-Vorhabens) for the German Federal Agency for Nature Conservation (BfN) standardised methods were used to demarcate German landscapes all over the country and to define their conservation value. The demarcation of different landscapes was mainly based upon data on natural boundaries and on current land-use. The natural boundaries were obtained from literature whereas land use data were identified by analysing satellite images (Corine-Landcover). For the overall analysis each landscape was assigned to a landscape type. A total of 855 landscapes were demarcated and except for 59 densely populated areas all of them have been described in the text (Map 2.9).

Eventually, each landscape was assigned to one of 24 different landscape types and to one of six geographical regions according to similar characteristics of defined features. In order to determine landscapes with a significant conservation value a preliminary assessment took place. For this assessment, data and information of similar quality and relevance from all over the German Republic were used. The level of landscape

MAP 2.9. German typology of landscapes. (Source: Gharadjedaghi *et al*. 2004)



fragmentation was assessed and it was taken into account if parts of a landscape were classified as nature reserves. Both aspects were considered separately and eventually complied for a final assessment.

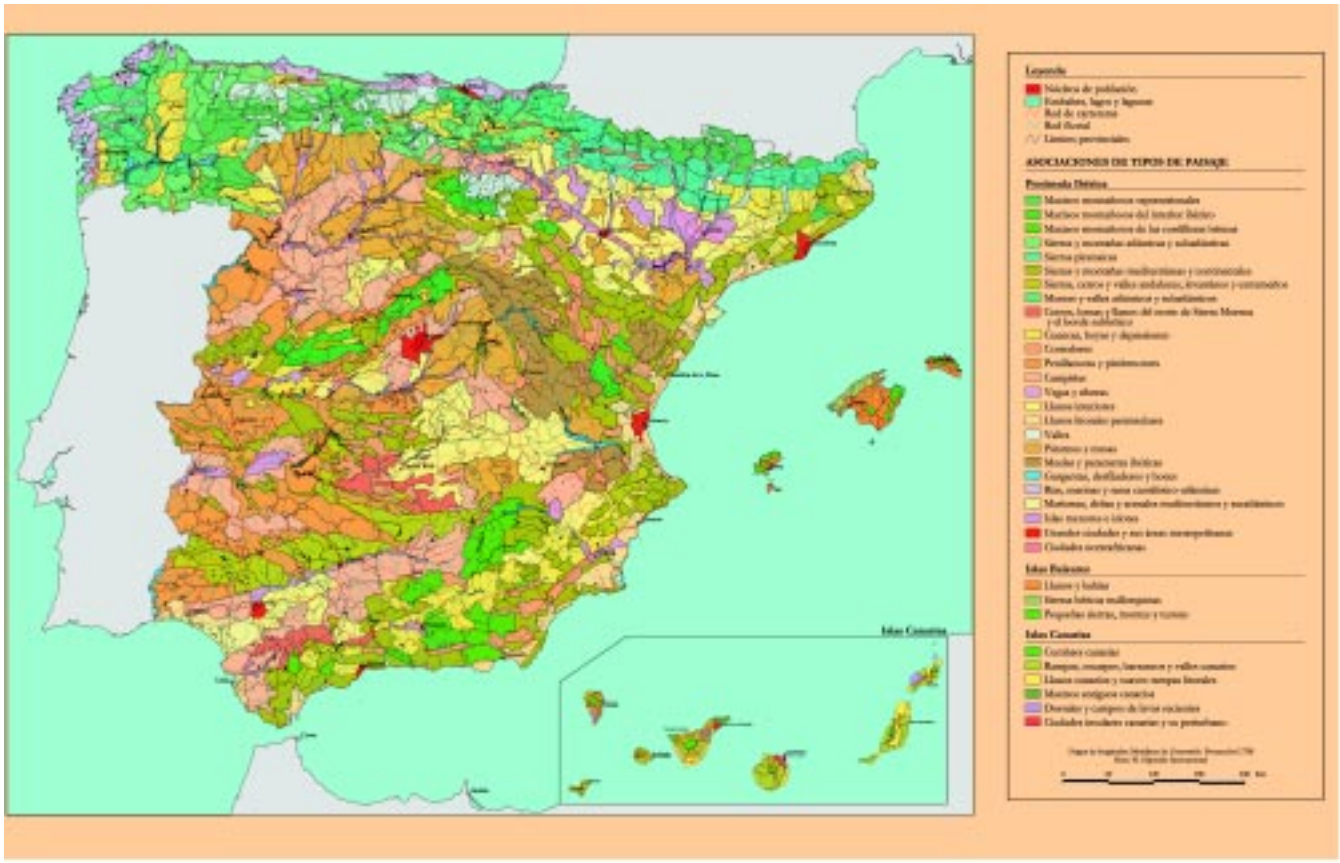
The results show that according to the set criteria a total of 401 landscapes (approximately 48.2% of the total area of the German Republic) are either meriting protection and are of great conservation value (85 landscapes, 12.1% of the total area), are merely meriting protection (76 landscapes, 7.3% of the total area) or are meriting protection but have deficiencies (240 landscapes, 28.8% of the total area).

For each landscape all relevant threats listed in the documents and plans which were analysed for this Research and Development Project have been compiled and conservation measures have been suggested.

Spain

In December, 1998 an agreement was signed between Spain's Environment Ministry (MMA) and the Autónoma University of Madrid (Geography Department) for the development of the project "Characterisation and identification of Spain's landscapes". The scale used in the identification and systematic demarcation of the Peninsula's landscapes was 1:200.000; this is a medium-level scale, which we considered to be suitable for application to the whole of Spain's territory, taking into account the project's objectives and possibilities.

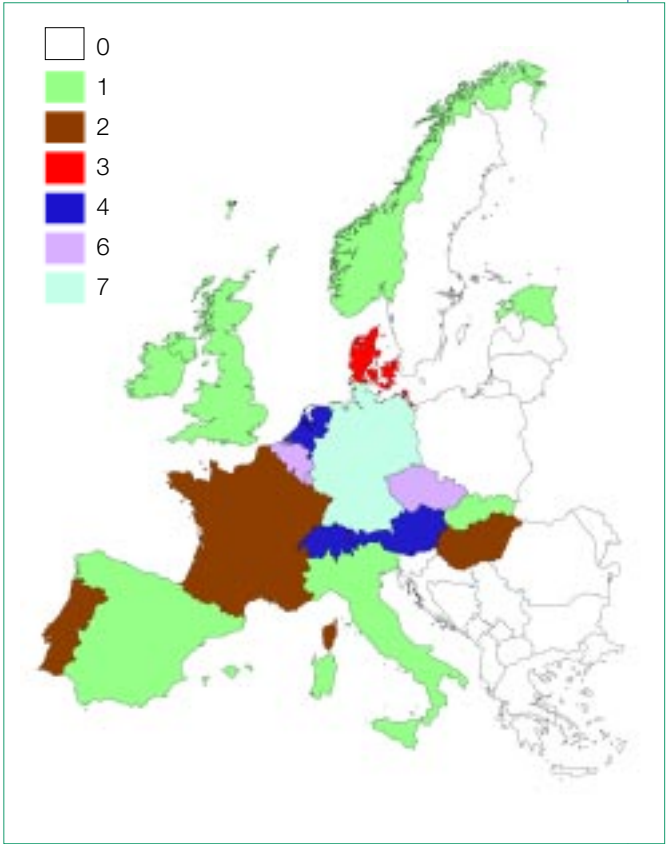
MAP 2.10. Spanish typology of landscapes. (Atlas de Paisajes Espanoles)



The work method comprised three levels: (1) *landscape units* or simply, *landscapes*; (2) *landscape types*; and (3) *landscape associations*. At the basic level, the diversity of Spain's landscapes is expressed by the so-called *landscape units* or simply, *landscapes.* Each of the 1,262 landcape units unit is defined by its homogeneity and its differences in relation to the neighbouring landscapes. Uniqueness is therefore the most characteristic feature and results from the particular relationships between local communities and their territory. From these, a representative selection of 94 landscapes on the Peninsula (one for each type) and 11 island ones have been described in more detail. The study of the cases selected was conducted using standardised forms, with four sections referring to certain other basic aspects of a territorial and dynamic characterisation of the landscape: (1) landscape organisation, (2) landscape dynamics, (3) perception of the landscape; and (4) landscape values. Lastly, a cultural text was conferred to each of the landscapes analysed.

The second level of the typology is what is known as *landscape type*, of which a total of 116 have been identified, mapped and described. Each type results from the grouping together of units the structures of which repeat throughout the territory. The landscape types are restricted, with very few exceptions, to regional domains because many of the landscapes at this scale respond to long-term processes, which have occurred within the framework of historic territories, currently within the regional scope.

Map 2.11. The number of ELCAI reviewed examples of LCA for each country.



At the highest level of the taxonomy stand the *Associations of types*, which integrate types that are similar due to their topographic configuration, to their bioclimatic characteristics and to similarities in the general organisation of land uses. In most cases, this level goes beyond the regional scope, considering physiographic features of the territory and providing a map that is relatively abstract in relation to the reality of the landscape, but useful as a general and synthetic cartographic expression, (see Map 2.10).

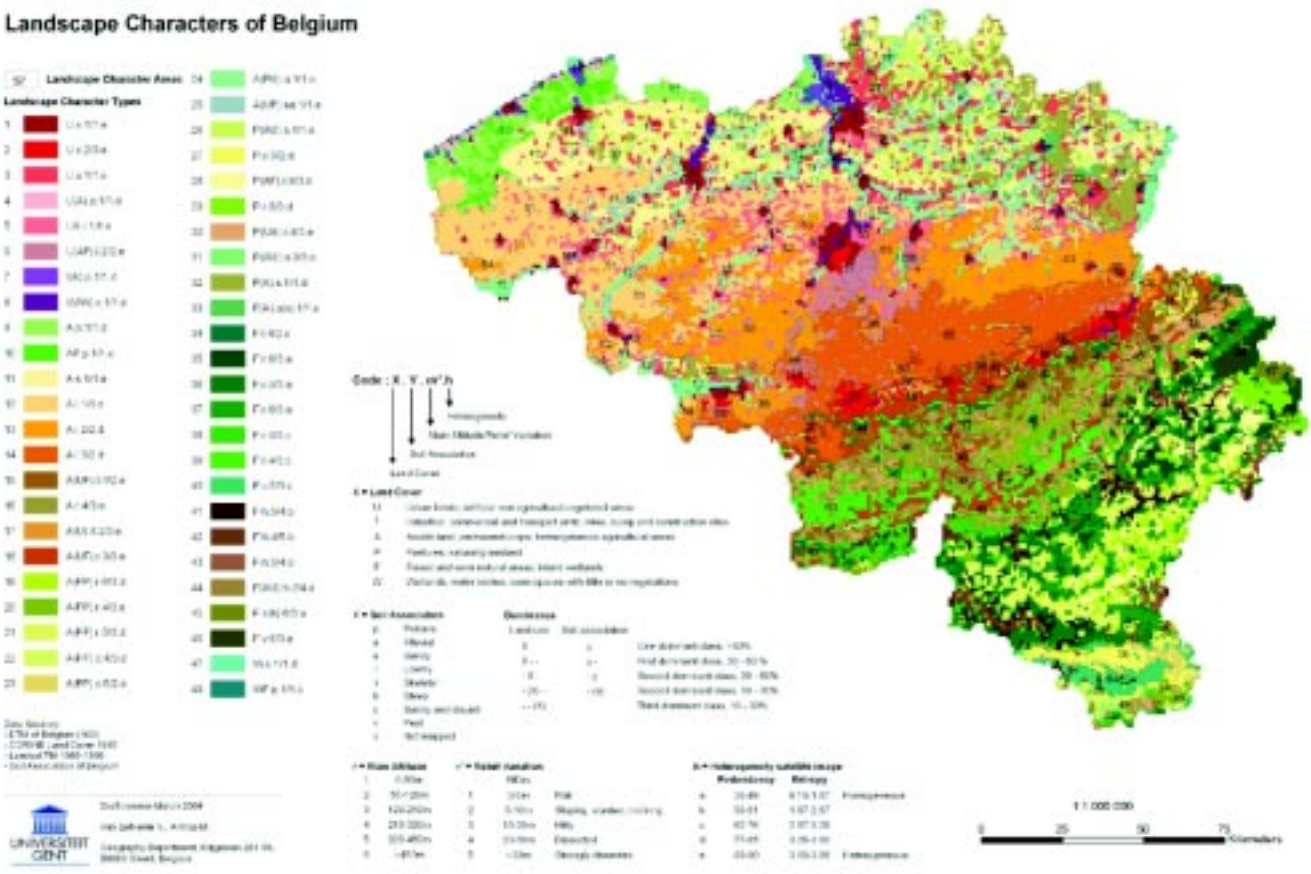
The identification and characterisation of Spain's landscapes at the different levels of the typology proposed are based, on one hand, on abundant cartographic, bibliographic and statistical documentation, processed in relation to landscape. On the other hand, the field work was vital. Over hundreds of days and always involving several members of the team of authors, it was decisive with regard to demarcation and morphological and visual characterisation, and provided us with one of the most important graphic contributions to the final document: a *photographic repertoire* which, albeit incomplete, is quite exhaustive, and suitably territorialised, of Spain's landscapes and of the dynamics thereof at the start of the XXI century (Mata Olmo and Herráiz 2005).

2.4.2 National and regional approaches reviewed in ELCAI

Data were gathered on a total of 51 individual examples of European LCA work. Most of these were presented to the review process through completion and submission of a questionnaire during the initial review period (spring 2003). A few completed questionnaires were submitted later. Four LCA examples (BE5, EE1, IT1, pe4, see Table 3.1) that came to the notice of the review after its main period of activity (February–December 2003) have also subsequently been included in the analysis, based upon submitted presentations and other source material. In many cases it was also possible to undertake further research on specific examples through use of the Internet to find dedicated web-pages and/or additional publications. Significant websites for the reviewed LCA example are given in the following national sections.

The geographical distribution of the examples (Map 2.11) largely reflects the partner composition of the ELCAI project. Most of the examples relate to nation states (e.g. The Netherlands, Hungary) or regions within nation states (e.g. Basse-Normandie). In many cases project partners submitted to the review two or more LCA examples relating to the same geographic extents, such

MAP 2.12. Map of the landscape characters of Belgium.



as a specific nation state, e.g. the two examples that both cover the whole of Hungary. The set of examples together covers all of the 14 countries represented by the project group. Some other countries are also represented (Italy, Estonia, Slovakia). The set of reviewed LCA examples includes four that have "pan-Europe" coverage.

Austria

Mapping of selected cultural landscapes in Austria
A method development for hierarchical (5 level) mapping, identification and characterisation of Austrian landscapes, in particular agricultural landscapes. Based upon consideration of biophysical and cultural aspects of landscape. Whilst intended as a national method, the detailed LCA was only made for 16 selected areas. A mixture of biophysical and cultural criteria is used. The methodology is a combination of field based mapping (i.e. expert interpretation) and numerical analysis.

SINUS (Landscape structure as indicator of sustainable land-use)
A top-down 2-level hierarchical typology and mapping of the LC of Austria. Based upon integration of biophysical and cultural landscape factors with image-derived identification and mapping of landscape mapping units (ca. 16,000) and types. Automated processing was followed by interactive refinement.
http://www.pph.univie.ac.at/intwo/in2intro.htm

ÖR7 (Landscape development model for the EUREGIO Bavarian Forest – Sumava – Mühlviertel)
LCA typology and mapping derived on basis of a set of sample locations, with consideration of biophysical and cultural factors. This was then integrated with a full area map of landscape units derived by interpretation of images to produce the map of cultural landscape types (four levels).
http://www.pph.univie.ac.at/oer7/index.htm#

National approach: commonly used for biodiversity assessments etc.
For example, the nine national ecoregions. The focus is on primary landscape structure, i.e. the defining factors are biophysical.

Belgium

The Landscape Atlas, Flanders
A 1:50,000 scale typology and description of relicts and landscapes related to landscape policy in Flanders, and focused on cultural factors (rather than geophysical or biotic). The methodology is a typology derived from historical maps, recent orthophotos, literature and experts as the data sources. The methodology makes interpretative analysis of the historical maps and recent orthophotos, combined with some field-based study and some assessment work. The guiding principles of the approach are land use, historical development, coherence, intactness and recognisability (i.e. sense of place). The outputs are maps of 'vestigial elements of the traditional landscape' and 'anchor places' (places of highest historical interest). Vestigial zones are areas with high densities of point and line relicts, vistas and anchor places and zones where the coherence of valuable elements determines the general appreciation of the entire landscape. Selection criteria are historic elements, archaeological sites, and geomorphologic structures, concentrations of point and line relicts, vistas and aesthetically unspoiled landscapes. A total of 515 vestigial zones have been defined, covering 39% of Flanders, and 381 anchor places have been defined, covering 16% of Flanders. A total of 4,607 point relicts and 544 line relicts have been defined. The anchor places are a subset of the vestigial zones; point and line relicts lie within and outside of the set of vestigial zones; no LCA is made of areas not considered as vestigial zones (apart from identification and mapping of point and line relicts). The methodology used to select and define the zones and relicts is expert interpretation.

Ecodistricts, Flanders
A typology and mapping related to environmental policy in Flanders, and focused mainly on geophysical aspects, with some consideration of biotic aspects. The methodology is based upon geophysical and biotic thematic maps and literature as the data sources, with GIS, statistical and descriptive analyses. The guiding principle of the approach is a real homogeneity for most of the bio-physical components. The output is a full coverage, 2-level (12 ecoregions, 36 ecodistricts) typology and mapping. The guiding principle for defining ecoregions is similarity of geological and geomorphologic properties. The ecoregions are further described by cluster analysis on the basis of flora and vegetation. Five of the ecoregions comprise single polygons with the other eight comprising several (maximum four) separated areas. All the ecodistricts are unique areas, i.e. classes that are represented by just one polygon.

Traditional Landscapes of Flanders
Work related to landscape policy in Flanders, and focused mainly on cultural aspects, with some consideration of geophysical aspects. The methodology is based upon thematic maps, literature and experts as the data sources. The methodology makes descriptive analysis with some field study and some assessment work. The guiding principle is to actualise the classical chorology of the geographical regions, reconstructing the pre-industrial spatial framework. Key criteria are geomorphology and soil and land ownership and historical development. The output is a full coverage typology and map with two hierarchical levels, and nine landscape regions at the higher level and 96 landscape entities at the lower level. The mapped units of the landscape regions can be singular or multiple; the mapping units of the landscape entities are believed to be singular.

Landscape Character Map
A LCA example related to landscape policy in Flanders, and focused mainly on cultural and biotic aspects. The methodology is production of a typology derived from thematic maps and literature as the data sources, made by GIS analyses. The output is single level. The map (see Map 2.12) brings together a wide variety of natural features (a selection of vegetation types, a selection of geomorphologic features, the drainage system, etc.) plus settlement patterns, particular land use patterns, historic

development features, and present-day artefacts and infrastructure. As such the characteristics of places, landscapes can be read from the map and the large data bank. However the map itself has no complete coverage of polygons that represent distinct landscapes or areas. So it is to be seen as a compilation of all available information and not (yet) interpreted as distinct landscapes.

Biological Valuation Map
A LCA example related to nature policy in Flanders, and focused on biotic aspects. The methodology is an ecotope typology, made by standardised field mapping, with a high dependence upon field work and assessment. The Biological Valuation Map is an example of "extended vegetation mapping": the predefined ecotopes hold land use categories and geomorphologic features as well as typical vegetation units. The output has two levels: most detailed is the level with the ecotopes or mapping units derived from very detailed field mapping (scale 1/10,000). Maps are described in accompanying textbooks. To structure this description and to reveal underlying similar ecological conditions (also used to help field surveys) the map also shows the second level, that is the bigger 'natural regions', comparable with one level below the ecodistricts (see above). This classification follows an interpretation of geology and geomorphology, hydrology and landscape history. The Biological Valuation Map is updated regularly.

Les Territoires Paysagers de Wallonie
Since 1998, the Walloon government created the Permanent Conference for Territorial Development (CPDT) to co-ordinate and stimulate interdisciplinary research on regional development and to build common datasets and maps. Some of the themes include rural development, environment and landscapes (Antrop 2001). A mapping of landscape units, called 'territoires paysager' has been achieved recently (Feltz *et al.* 2004). 76 landscape units were defined and grouped into 13 regions ('ensembles'). Two types of units are recognised: 'classic' territories and an overlay of a-modal territories, which mainly refer to the deep valleys.

http://mrw.wallonie.be/dgatlp/dgatlp/Pages/DGATLP/Dwnld/CarteTerritoiresPaysagers_A4_150dpi.pdf
http://mrw.wallonie.be/dgatlp/dgatlp/Pages/DGATLP/Dwnld/TerritoiresPaysagers.pdf

Landscape characters of Belgium
This is a recent (post 2000) programme to establish a landscape typology for Belgium as a whole at a scale of 1:1million. Data, for each 1 km^2, relating to land cover (six variables), heterogeneity (one variable), soil type (nine variables) and relief (two variables) have provided the basis for an automated (k-means clustering) definition of 48 landscape types. Each 1 km^2 has been allocated of one of the types. Landscape regions have then been formed as unique combinations of the landscape types; the regions are adjusted for visible landscape borders using the cluster groups and the satellite images. The landscape regions are aggregated to 198 landscape units (i.e. individual polygons) that comprise 67 Landscape Character Areas based on hierarchical clustering using the 48 landscape types as variables in order to reflect visual characteristics associated with the landscape types.

http://geoweb.rug.ac.be/services/docs/LCA1_Belgium_ECLAI2004.pdf
(This website includes good information on other Belgian LCA too.)

Switzerland
Landscape Concept Switzerland
A conceptual basis for a wide range of landscape-related activity, including the potential for LCA.

http://www.umwelt-schweiz.ch/buwal/eng/fachgebiete/fg_land/lks/index.html
http://www.swisslandscapeconcept.ch/e/_start.htm

Indicators for sustainable landscape development (Landscape 2020)
A GIS-based methodology for generation of a set of measuring tools (indicators) to assess sustainability. This is a supplementary activity to the Landscape Concept Switzerland (CH1). It has the potential for output of diverse mappings with administrative units (cantons) as the basic mapping unit. These mappings could be used as a basis for LCA.

http://www.umwelt-schweiz.ch/buwal/eng/fachgebiete/fg_land/land2020/index.html

Swiss Landscapes of National Importance (BLN inventory)
A spatially explicit 'unique areas description', i.e. description of the landscape character of a subset of (162) selected areas and sites. The BLN is the first federal inventory issued by the Federal Council on the basis of the Federal Law on the Protection of Nature and Cultural Heritage (LPNH). The BLN is based on the Inventory of Landscapes and Natural Monuments to be Preserved (KLN Inventory), which was issued in 1963. The BLN includes sites of three different types: Unique sites (sites that are unique from a Swiss or even European perspective by virtue of their beauty, individual character, or scientific, ecological, or cultural-geographical significance), Typical Landscapes (cultural landscapes, generally of a near-natural character, that contain landforms typical of a region, cultural-historical features and important habitats for flora and fauna) and Natural Monuments (individual features of animate or inanimate nature, such as erratic blocks, exposed geological sections or typical landscape forms. When sites of this type are protected, the emphasis in on the overall appearance of the landscape).

http://www.umwelt-schweiz.ch/buwal/eng/fachgebiete/fg_land/bln/index.html

Landscape quality of Mobilité Spatiale Regions (Swiss economic planning regions)
A spatially explicit valuation and typology of the 106 Swiss planning regions, i.e. the national coverage of cantons to one of six landscape types. Data relating to these spatial units are used to derive mappings of landscape quality.

http://www.wsl.ch/land/products/biosphaere/

Czech Republic
LCA for Public Administration
Conceptual basis and methodological recommendations

for LCA in Czech Republic. A wide range of criteria are noted as relevant.

LCA (Methodology of Bukácek and Matejka, 1997)
Four level LCA typology and mapping based around biophysical, cultural and aesthetic criteria. Designed for use on designated Landscape planning Areas and National Parks. The methodology is expert interpretation to derive LCA units, with a preference for analogue procedures rather than digital.

Landscape values in the city of Pilsen master plan
An atypical (i.e. urban) example of local level LCA work in Czech Republic. Natural, cultural and aesthetic criteria based LCA typology and mapping. The methodology is expert interpretation to derive LCA units.

Landscaping Assessment - Territorial projection of significant landscape elements (based on "Terplan" ideas)
Two-level national typology and mapping. The first level is three basic landscape types: fully anthropogenised, harmonic cultural landscape, relatively natural landscape. For each of these the second level is: increased, basic (average) or decreased landscape value; these are determined more or less subjectively. This gives nine types. A wide range of mainly biophysical or human-impact-on-the-environment criteria are used.

Biogeographical division of the Czech Republic
An expression of a concept for synthesis of previous Czech LCA methodologies and guidelines, with focus in this part on the biophysical aspects, resulting in a hierarchical grouping of 90 bioregions and 372 biochores. This has been proposed as a framework for LCA by Low and by Míchal.

Concept of Kolejka and Lipsky 1997
A research concept for typology and mapping of landscapes (mono- or poly-functional types) based upon natural structure and anthropogenic structure factors.

Germany
Environmental monitoring
A methodology for flexible national definition and mapping of raster cells (2x2 km) based on their geophysical characteristics (soil, climate, elevation), taking potential natural vegetation (PnV) as a derived integrating variable. Developed as a basis for environmental sampling. Uses the Classification and Regression Trees (CART) methods. Various typology and mappings can be made.

Geographical characterisation
An approach for deriving and describing 'local' (1:100,000 scale) spatial units with homogeneous natural character – the 'Naturraum' (potentials of the natural space) concept – made in connection with planning purposes and ecological evaluations. Biophysical criteria are combined with expert knowledge and intuition. The general Naturraum approach has been implemented in various ways for different federal states.

Classification of natural landscapes of Germany
Typology and mapping of natural units from the 1950s, based on biophysical factors and derived by expert interpretation. Two levels, with the 89 upper level units derived by combination of 504 lower level units; all units are geographically unique and singular.

Types and regions of the former GDR
Science driven typology and mapping of natural units from the 1970s, based on biophysical factors and derived by expert interpretation. Four-level hierarchical typology; all levels are generic and classes can have multiple mapped areas. A total of 2,167 areas are mapped.

Natural areas and natural area potentials of Saxony
Planning orientated typology and mapping of natural areas from the 1990s, with an emphasis on visualisations of landscape. The approach uses biophysical factors and land use. Also uses existing landscape maps as a source. The main, level-3 product is a reference set of 1,462 heterogeneous microgeochores that represent particular patterns of fundamental landscape characteristics The methodology has both deductive ("top-down") and inductive ("bottom-up") elements. The base reference units are nested into a hierarchical 3-level typology.

Ecological sampling areas, Germany
Typology and mapping as a basis for stratified ecological sampling. The LCA is made in terms of 2-km raster map units. Two levels are defined, with 20 more-or-less unique landscape types defined at the lower level and six more-or-less generic types at the upper level. Elevation, climate, soil and land cover are the defining criteria. The methodology used is map overlay for classification.

Landscape types in Germany
A recent (2004) national typology and mapping of 855 landscape units (including 59 densely populated areas), which are also ascribed to six natural structural types and six regions. The work draws upon the earlier developed 'Classification of natural landscapes of Germany' (Meynen *et al*. 1962) as the base with overlay of soil cover and land cover and information on cultural and historic development and landscape structure. Topographic maps (1:200,000), soil maps and CORINE land cover provide these additions. The method is GIS-based delineation and analysis and interpretation. For more information please see Section 2.4.1.

Denmark
Landscape regions on a national level (Cultural landscapes in Denmark)
LCA typology and mapping from the 1980s based on geophysical factors (geomorphology, soil, climate) and cultural factors (general land use, special themes). The underlying focus is on areas with uniformity in terms of their historical stability, their vulnerability and their broad economic productivity. Part of a pan-Nordic programme for developing links between natural and cultural landscape issues and spatial planning. Non-hierarchical, 69 unique, mostly single polygon landscape types are defined, mapped and described; units defined and delimited by expert judgement.

Valuable landscapes in the Roskilde region
A planning process approach for delimitation and mapping of local (1:100,000) spatial units ('districts') on

the basis of a range of landscape considerations (geophysical, cultural and historic, perception and aesthetics) as a basis for vulnerability assessment. The delimitation is not based on a predefined typology, but expert judgement of areas that are homogeneous according to the character, structure and interaction of landscape elements.

Landscape Character Assessment in Denmark
A developing method for LCA typology and mapping that considers biophysical, cultural, aesthetic criteria and stakeholder input in defining landscape character units at national, regional and local levels. It is an integration of analytical and interpretative approaches and it combines automated (GIS) and interactive (field-based) methods. In order to secure an appropriate utilisation of the three levels, landscape elements, which are in some way already registered on existing digital maps, have been favoured. On level 1 the Corine classification is used. On levels 2 and 3 the Danish area information system (AIS) including the digital topographic map and the county's protected nature area registration are used.

Estonia
Estonian "Landscape Character Assessments" (Granö 1922)
As a theorist and empiricist at the interface of geography and landscape, Granö, in ways that were ahead of his time (1920s mainly), developed a regional science approach that, distinct from contemporary regional geography, emphasised environment observation by human sensory (scientifically nurtured) perceptions as the basis for defining regions. This included a precise, purpose-built pragmatic terminology for making generalisations concerning 'proximities' (the immediate environments) and 'landscapes' (the distant environments). Thus 'landscape' observations include perceptions of landforms, water, coasts, vegetation, fauna, artificial forms (e.g. buildings), mobile forms (e.g. clouds) variable forms (e.g. seasons), colours and lights. And, the task of delimiting regions is a process of overlay of map representations of these perceptions allowing definition of core areas and transition zones, the size of which relate to the required degree of generalisation or detail. These ideas were developed in the context of national mapping of Estonia, but later also applied for Finland. Granö "succeeded in (1) treating landscapes in a revealing manner as perceptual environments, and (2) developing an analytical method for defining regions, attempting to combine these two as consecutive stages in the same research process" (from the Preamble to the 1997 English translation of Granö 1929).

Spain
Spanish Landscape Atlas
A recent (post 2000) national typology and mapping of landscape identification, characterisation and cartography. The basic information is on a scale 1:200,000. The typology comprises two levels, with 1,263 map units allocated to 116 landscape types at the lower level.

For more information please see Section 2.4.1.

France
A national framework for "landscape atlases" (Lower Normandy as an example)
A two-level, typology and mapping of LCA units on basis of biophysical and cultural/historic factors. The methodology is visual field survey, working with a topographic map. There is also some stakeholder input, but this is mainly to add detail after the typology and mapping of landscape character units has been completed (see Map 2.13).

The landscape in territorial planning: experience in Limousin
A methodological framework for open generation of regional and local expressions of landscape character for specific management and planning purposes, taking biophysical factors as a basis for landscape units. There is stakeholder input to the form that the framework takes.

United Kingdom
Countryside Character Initiative (England)
The Countryside Character Initiative is a programme of information and advice on the character of the English countryside. It includes systematic descriptions of the features and characteristics that make the landscape, and guidance documents on how to undertake Landscape Character Assessment. LCA work in England through the last ca. 10 years has seen the need for typology and mapping of both Landscape Character Areas and Landscape Character Types at different spatial scales. In 1996 the former Countryside Commission and English Nature, with support from English Heritage, produced The Countryside of England map. This combines English Nature's Natural Areas and the former Countryside Commission's countryside character areas into a map of joint character areas. This map comprises 159 unique character areas. The joint character areas are identified by professional judgement, validated by consensus and informed by multivariate analysis of map information. In 1999 the Countryside Agency commissioned the development of a National Countryside Character database and Geographical Information System. The aim of the database was to identify, on a consistent basis, the key characteristics of each area, in order to assist the targeting of agri-environment schemes. This study developed what is now known as the draft Landscape Typology for England. The typology was developed through a desk-based exercise on the basis that particular combinations of factors that have the strongest influence on landscape occur in many different parts of the countryside. These three key factors are physiography (altitude and geology), land cover (ecological character from the interpretation of soils, farm type) and cultural patterns (historic settlement and land use). The National Landscape Typology (NLT) for England comprises 79 generic Landscape Character Types and a total of 587 individual LCT areas across England. This two-tiered national (typical scale 1:250,000) top-down LCA work is mirrored by bottom-up processes for identification of both types and areas by local authorities (at scales of 1:50,000, 1:25,000) and also by more local scales (1:10,000) assessments. At each level, the types are generic entities with multiple polygons, whereas the areas are unique entities with single polygons.

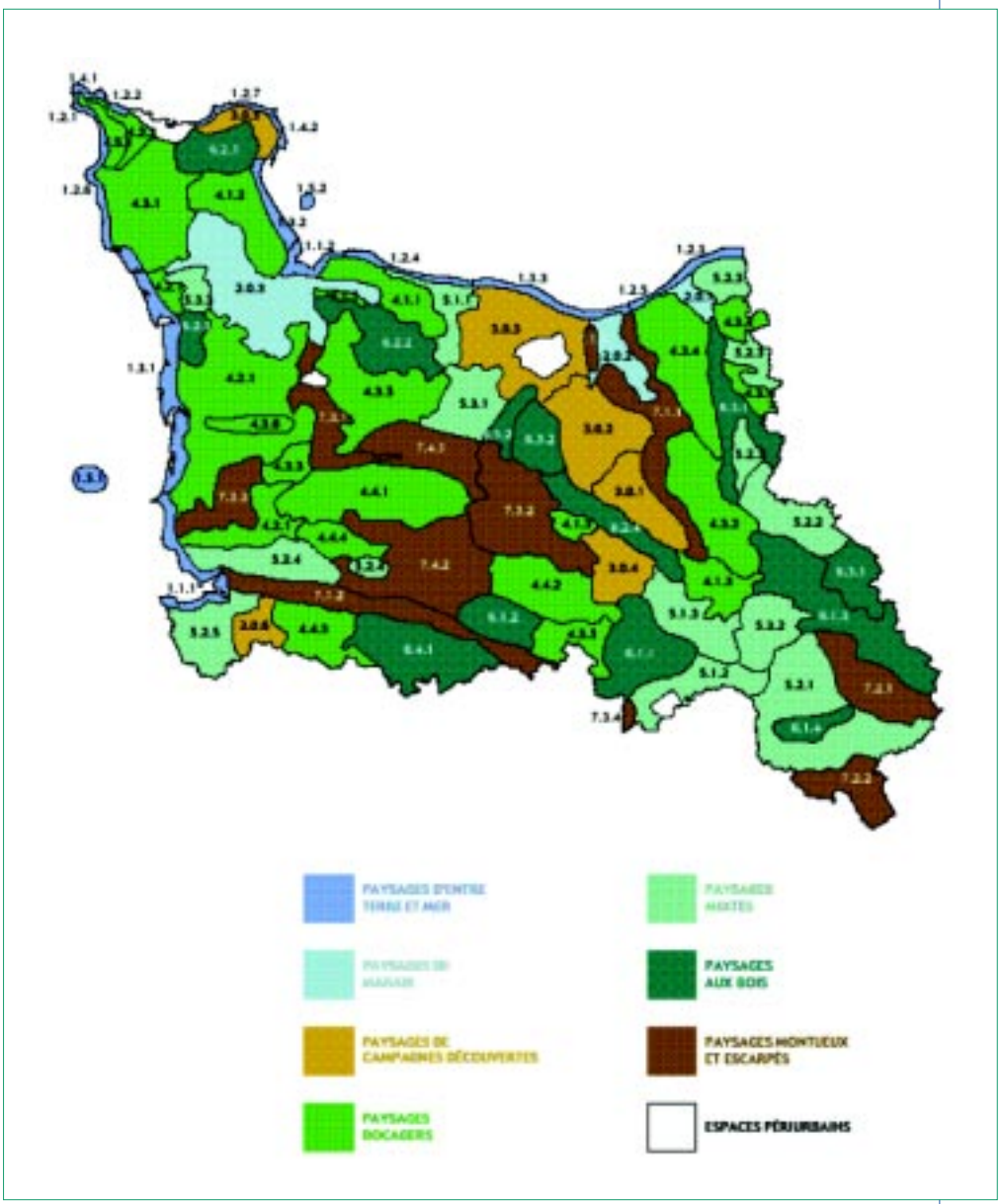
http://www.countryside.gov.uk/LAR/Landscape/CC/index.asp
http://www.countryside.gov.uk/LAR/Landscape/CC/landscape/publication/index.asp

For more information please see Section 2.4.1.

Scottish national programme of Landscape Character Assessment
As in England, Scotland has seen since the mid 1990s parallel development of Landscape Character Area and Landscape Character Type typology and mapping work. Thirty-one regional LCA reports were made covering the whole of Scotland; the work was at first piecemeal and variable in its working methods. However in general the base LC area mapping considers objective (biophysical, cultural, historic) and subjective (perceptual, aesthetic) criteria and integrates deterministic desk study work with field survey and expert judgements in its methodology. The 31 reports identified both Landscape Character Areas and Landscape Character Types. In total 3,967 areas were mapped, that were allocated to 366 Landscape Character Types (LCT). Subsequent analysis of these areas and types has resulted in the identification of 275, 121 and 55 LCTs at three hierarchical levels (see Map 2.14).
http://www.snh.org.uk/wwo/sharinggoodpractice/landscape_guidance.asp

Northern Ireland Landscape Character Assessment 2000
In Northern Ireland (NI), the Environment and Heritage Service began a NI-wide LCA in 1997 that was completed and published in 2000 (Environmental Resources Management 2000. It identifies 130 unique Landscape Character Areas across the region based on geomorphology, landscape setting, biodiversity, land use

MAP 2.13. Map of the landscape units and sub-units of Lower Normandy.



and cultural pattern factors. Broad descriptions of regional landscapes (such as the Antrim Plateau) and more detailed descriptions of individual character areas are provided in a series of 26 LCA reports organised by local government district. These reports describe landscape character, analyse landscape qualities and features and provide principles for landscape management and accommodating new development.

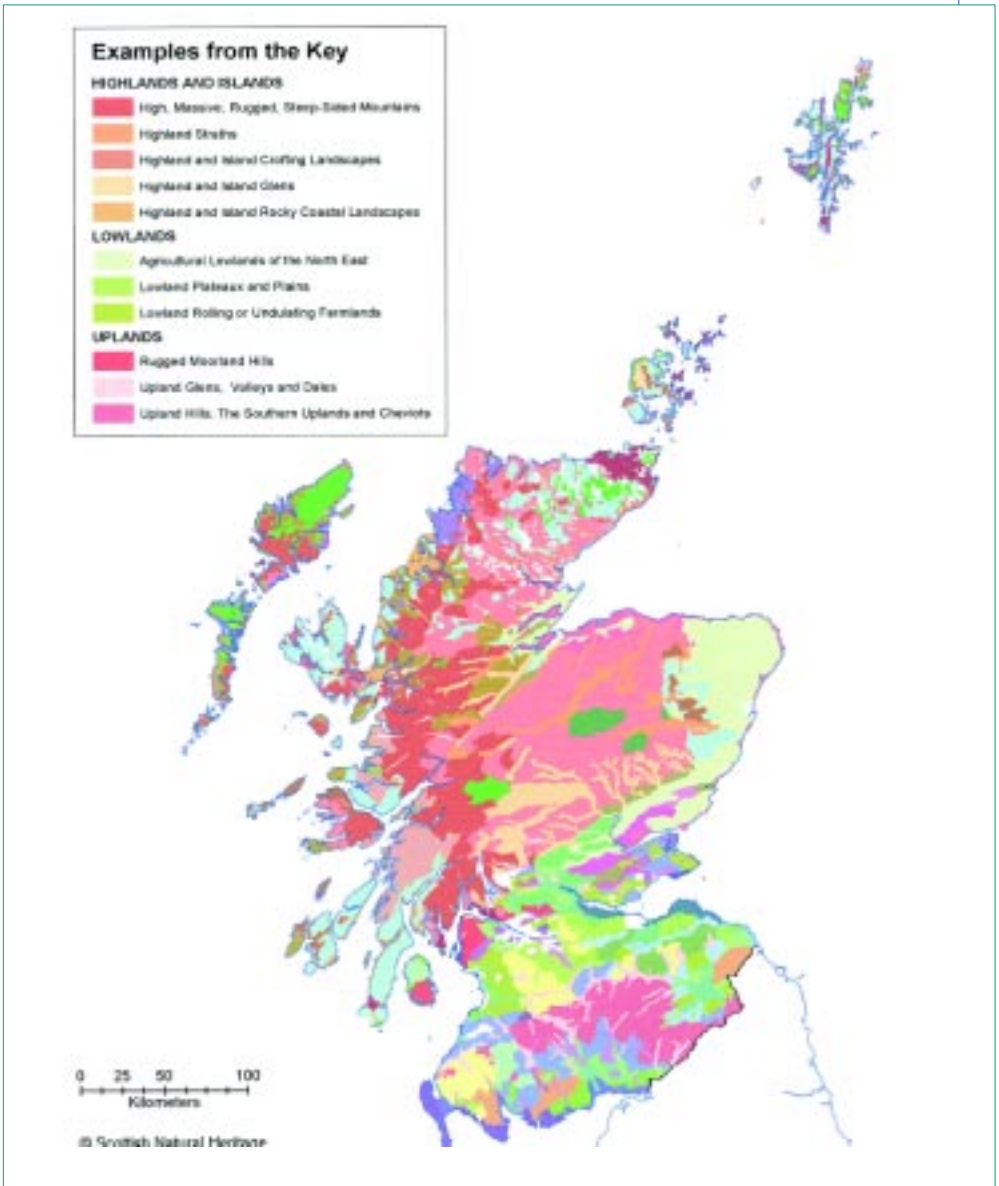
Mapping was done manually using extensive field survey and use of topographic, geology, etc. maps as data, and was based on interpretation by landscape architects, following Landscape Assessment guidelines set out by the Countryside Commission in 1993. GIS was not available. Inherent landscape character, condition and context were all considered. The classification and description is consistent across Northern Ireland because the assessment was undertaken as a single exercise. Through additional research, the assessments have been further developed to include detailed information on biodiversity and earth science for each Landscape Character Area.

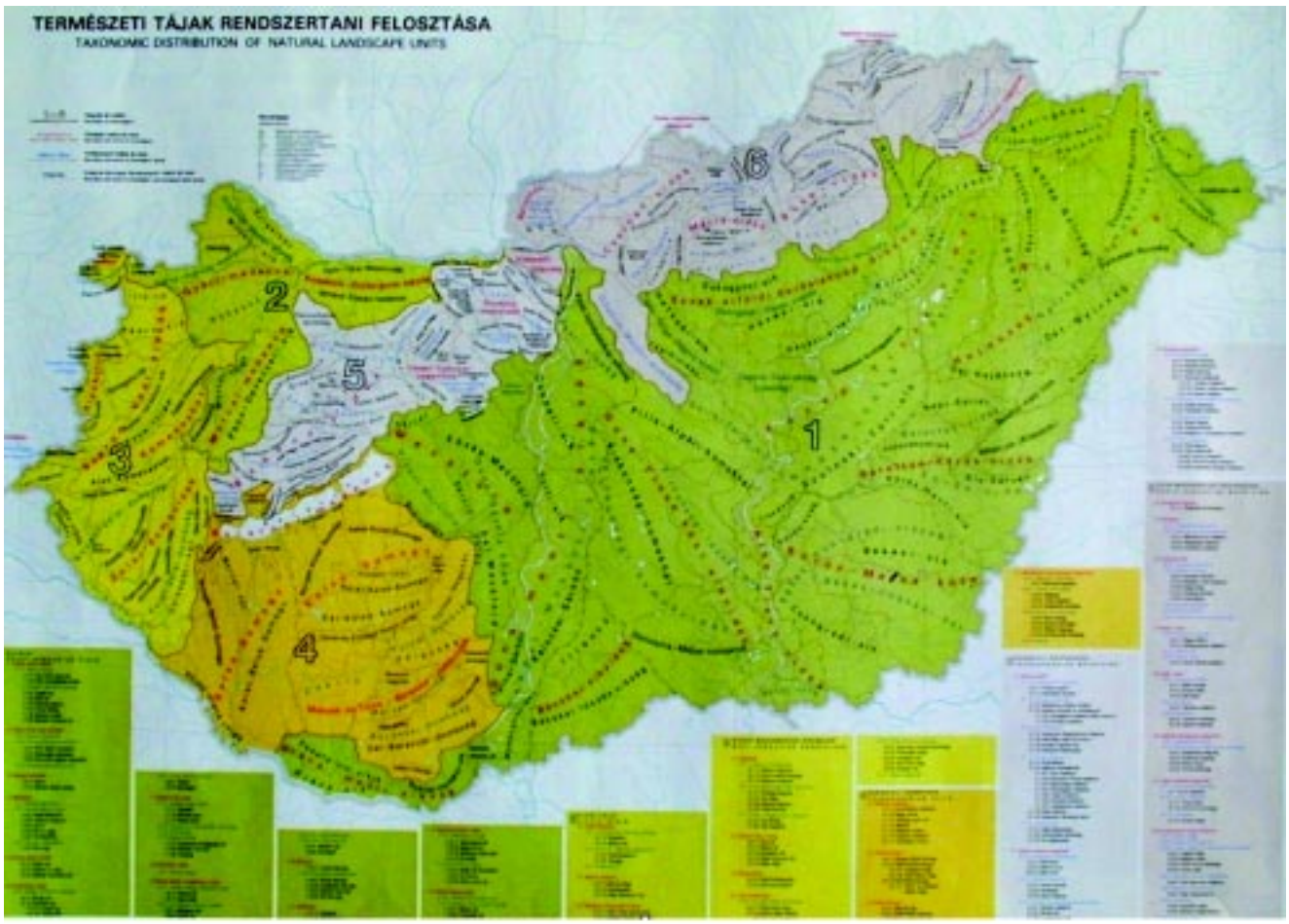
http://www.ehsni.gov.uk/natural/country/country_landscape.shtml

LANDMAP information system (Wales)

Since 1994 the Countryside Council for Wales (CCW) has established the LANDMAP information system. This is an open methodology for making Landscape Character Assessments through building a GIS database of relevant landscape information. The information is compiled at county level (generally by consultants) but is organised and validated at national level by CCW to provide a national consistent dataset. The database comprises contextual information, information on five specialised LCA aspects (earth science, biodiversity,

MAP 2.14. Map of the Landscape Character Types of Scotland.





MAP 2.15. Taxonomic distribution of natural landscape units in Hungary. (Keresztesi *et al*. 1985)

visual and sensory, history and archaeology, cultural) and public perception information. Classification, description and evaluation for the five aspects are integrated and standardised for each aspect, the aim being to derive a map of evaluated aspect areas for each aspect, to place within the database. A vast but consistently used range of criteria is applied for these evaluations of the areas of each aspect. Landmap does not necessarily produce an integrated landscape characterisation as such – this is optional, with greater attention placed on the individual qualities that make up the landscape. A key characteristic of the LANDMAP approach is that the information and outputs are a shared resource for use by local authorities and a wide range of government department and agencies (Julie Martin Associates and Swanwick 2003). LANDMAP represents a rather unique example within this review).

http://www.ccw.gov.uk/Generalinfo/index.cfm?Subject=Landscapeandlang=en

Hungary

Taxonomic distribution of natural landscapes

National coverage, geophysical factor focused 3-level hierarchical LCA from 1970, used as a basis for a micro-landscape (200 types) inventory. The methodology was expert interpretation (see Map 2.15).

Landscape types

National coverage, 3-level hierarchical LCA, based on geo-, biophysical factors, from the 1980s. Some consideration of land use, for some Landscape Character Types. Types at all levels are landscape types (not character areas). The methodology was expert interpretation.

Ireland

Landscape Character Assessment in County Clare

Under the Planning and Development Act 2000, which became law in 2001, local authorities in Ireland are required to prepare an LCA as a precursor to any new development plan. LCA is also strongly encouraged by the Heritage Council, the Irish government's adviser on landscape policy. So far there is coverage of seven counties (out of 27). There are ongoing moves to provide national co-ordination and/or a 'top down' national landscape characterisation. The County Clare LCA began in 1999 as a pilot study investigating the suitability of using GIS as a basis for LCA and assessing the available digital data relating to geology, land cover, natural and cultural designations. The study sought to develop landscape types using only GIS. A mapping of 17 Landscape Character Types (LCTs, 27 polygons) was produced. A typology and mapping of

19 Historic Landscape Types (HLTs, many polygons) was also made. The HLTs are seen as a distinct expression of landscapes "based on the scale and integrity of the archaeological features [that] reflect significantly on the human history and land use" (ERM Ireland Ltd 2004). The aim of the follow-on 2002 County Clare study was to demonstrate best practice in LCA (ERM Ireland Ltd 2004). This work involved use of additional digital data (surface geology, glacial deposits, settlement patterns, ecology, archaeology), additional GIS analysis, fieldwork, further baseline research and consultation (community and administration directed workshops). These processes resulted in extension and refinement of the original LCTs (giving 26 LCTs, 39 polygons plus two urban areas) and identification and mapping of 21 Landscape Character Areas (21 polygons). The boundaries of the LCT and LCA polygons are distinct from each other and most LCAs comprise several LCTs. The 2002 study also identified and mapped 12 Seascape Character Areas. The 2002 work also identified 30 habitat types. In both the pilot study and the 2002 study GIS was used to assist the making of typologies and mappings through the handling and understanding of map data and identification of key landscape drivers, rather than analytical processing of data to directly derive, for example, the LCT areas.

http://www.heritagecouncil.ie/publications/clare_landscape/index.html

Italy

Classification of Italian landscapes

Recent (post-2000) work developing the mapping of macro-landscapes (either four or eight landscape spatial configuration types) from a geophysical (geology, landform) based mapping of 38 landscape types. The macro-landscape mapping uses cluster analysis of CORINE land cover level 1 or level 2 data for the derivation of the four or eight landscape spatial configuration types. Further development will also use bioclimate, lithomorphology, vegetation series and CORINE land cover level 4 data as additional factors.

The Netherlands

Ecological Landscape Indicators

Contemporary ideas in The Netherlands regarding strategic environmental work favour flexible, multi-functional research and application tools, by which multiple data and concept layers can be integrated to provide a range of spatial output products. Hence this is an example of an open mode of making, among other things, LCA. This approach is widely applied within the "Meetnet Landschap" monitoring network for a systematic approach to monitor the effects of changes in the landscape. Indices are seen as a key mechanism for this monitoring. One Meetnet example provided to the review illustrates the generation of an ecological landscape indices product. The potential for additional derived generation of typologies and mappings representing landscape character is indirectly implied. The base spatial units involved in map output are raster cells of various sizes. The method used is basically one of automated generation of customised LCA and other information products.

Nota Landschap 9 Landschapstypen

National coverage 'rough draft' typology and mapping of the main Dutch landscape types, based on soil and geophysical factors. Nine landscapes types and 16 sub-types are defined, starting with the types (i.e. "top-down"). The method used is that of automated classification of map layers.

Histland

National coverage typology and mapping of the main Dutch landscape types, based on "bottom-up" classification of small polygons with unique landscape genesis and historical geophysical factors, amalgamated into a set of 11 (unique) landscape types. (N.B. these types are not 'unique' in the sense used in Table 3, i.e. that each type is associated with a specific geographically location.)

VIRUS (Visual spatial information-system)

This is a further expression of the Meetnet concepts and methods, here for open generation of expressions of 'characterisations of scale' in the landscape. The focus is on the specific criteria 'buildings' and 'climbing vegetation'.

Physical geographic regions

In the framework of nature conservation policy, the Dutch Ministry of Agriculture, Nature and Food Quality is making use of a generic map of physical geographic regions for the The Netherlands. Since this map is of too low resolution for certain types of nature management tasks – e.g. implementing the concept of 'nature target types' (natuurdoeltypen) – a much more detailed map in the scape of 1:50.000 was necessary (see Map 2.16). By a very consequent adaptation of analytical rule settings, this new map unveils aspects that have not been captured by the previous Nature Planning Bureau (NPB) map. E.g. in the new map, polder areas are part of the marine cley regions.

Norway

The Norwegian Landscape Reference System

This is a direct attempt to define and map LCA units that are relevant for issues of environmental management and physical planning, compared to existing administrative spatial units that are poorly related to landscape. The present division into 444 landscape sub-regions and 45 regions was completed in 1996 (with some minor adjustments after this). At the local scale (1:50,000), 'landscape areas' and 'landscape types' have also been defined for some municipalities. Region and sub-region mapping units tend towards being unique character areas with place names widely used for sub-regions, but given the complex physical geography of Norway the regions in particular can comprise multiple polygons. At all three levels a systematic description is based on six factors:

1. major landform
2. geological composition
3. water and waterways
4. vegetation patterns
5. agricultural areas
6. buildings and technical installations.

The landscape character is a synthesis of these six factors. However, the importance of the factors varies

Map 2.16. Physical geographic regions. (Source: IKC Nature Policy)

between the different landscape regions. At the level of the landscape areas the concept of "landscape rooms" is significant. The methodology for deriving and mapping the landscape regions and sub-regions is mainly expert interpretation based on maps and data including field work and pictoral representations (such as photos). Aggregation of the 45 landscape regions into 10 "Agricultural Regions" ("farmscapes") was completed in 1998.

http://www.nijos.no/index.asp?topExpand=1000102andsubExpand=andmenuid=1000800andstrUrl=//applications/system/publish/view/showobject.asp?infoobjectid=1002692andcontext=13

Portugal

Landscape Characterisation in Portugal

A typology and mapping of the whole of Portugal (and also the Azores) as a 2-level hierarchical set of unique landscape character units. At both levels all units are mapped as single polygons and they are presented in a standardised cartographic and descriptive format. The set of criteria used is broad, with representation of biophysical, cultural and experiential factors. Landscape units have been defined by a mixture of map overlay, empirical knowledge and expert assessment, with recognition of the need for flexibility in the weights given to different factors in different cases.

Landscape Units Guadiana Natural Park

A typology and mapping made for the full extent of a specific area as part of its management plan. LCA units are defined on two levels. Biophysical, cultural and experiential criteria are involved and the methodology is mainly map overlay based interpretation with field verification.

Slovak Republic

Landscape Atlas of the Slovak Republic

The work on this encyclopaedic piece started already in 1996 and presents 25 national mappings relating to landscape and their character. Preparations were made under the auspices of the Ministry of Culture of the SR and since 1999 the Ministry of Environment of the SR co-ordinated them. The work was managed by the 18-member Editorial Board and the nine-member Executive Board was responsible for the expert aspects of the content of the Atlas. In total 367 national and foreign experts from 85 scientific, university, research and specialised institutions participated in compilation of the Atlas. The Landscape Atlas of the Slovak Republic is divided from the point of view of the themes into ten chapters with subchapters.

The aspects covered include primary landscape structure aspects (geology, landform, soil, hydrology, vegetation, and fauna), secondary landscape structure aspects (land use, special landscape structure (see Map 2.17, over), real vegetation) and tertiary landscape structure aspects (population, settlements, agriculture, industry, transport, tourism, services). Some of these are mapped as LC-Types, others as LC-Areas, and this also varies between hierarchical levels for specific aspects. Synthesis is presented in the form of LC-Type mapping of landscape-ecological complexes with a 2-level (plus an urban level) hierarchy.

2.4.3 Conclusions

The above compilation of European landscape maps and typologies must be considered as being limited and far from exhaustive. However, while a fairly large number of regional classifications and maps have certainly not been included, the selection is likely to cover the most recent key national and international approaches in participating countries, especially those that have been digitised and exposed to a political debate. At the national and international level, many historical, geographic and ecological maps have been produced and published in books and atlas publications as well as printed images. Obviously, these works have not been included in this survey, though they might contain valuable information for the identification of Landscape Character Areas. Elaborating and deepening the research effort must hence be considered to be a future challenge which is likely to produce rewarding results.

Given the purpose and resources of the ELCAI project, the cross-analysis of 55 landscape maps with their typologies, indicators and policy role is probably one of the most comprehensive approaches in this field over the last years. However, this achievement

Map 2.17. Distribution of viticulture regions as part of the special landscape structure assessment in the Landscape Atlas of the Slovak Republic. (Source: Ministry of Culture of the Slovak Republic, National Monument and Landscape Centre, Institute of Landscape Ecology of Slovak Academy of Sciences, Faculty of Natural sciences UK, and Faculty of Architecture STU, 1997)

could only be reached on the expense of the depth and elaboration that has been dedicated to the individual examples. Each of the maps which are analysed and discussed actually deserve to be studied and described in much more detail than is possible here. To quote one of the researchers at Alterra: "Maps offer the richest information in printed documents that there is: no book can ever address the myriad of relations, details and possible interpretations that are expressed by the graphic language of a map." (Slim 2005).

Though a better understanding of landscape character certainly will require more in-depth research of specific national and regional maps and even of concrete sites, the ELCAI study is ultimately dedicated to the European level. In this way, it must rely on a strategic division of research activities between different levels of scale and scientific orientation. Providing this European-wide overview and analysis in the following chapters will hopefully also stimulate and assist regional and national experts in their future work and in the choices they make.

2.5 A new integrated international approach: LANMAP

In the face of the increasing demand for more accurate and policy-oriented geo-spatial data on landscapes at the European level, a research team at Alterra initiated a new approach for the identification and characterisation of landscapes in Europe in 2003. The intention was to overcome previously observed shortcomings such as inconsistencies in the legend structure, too high levels of generalisations due to global scale and/or applied input data, and lack of methodological integration between and with existing national approaches.

2.5.1 Objectives and challenges

The new European approach was supposed to provide a practical and agreed-upon tool for the implementation of landscape-related policies. Important future applications include integrated environmental assessment, sustainability impact assessment, indicator-based monitoring and reporting on landscapes, and especially agri-environmental assessments.

To achieve the aim the following tasks had to be fulfilled:

- development of a conceptual framework
- identification of necessary and available data sets
- set-up of a European landscape typology
- development of a flexible methodology to identify major landscape types
- creation of a European landscape map on a scale between 1:1 million and 1:5 million.

In dependence on the quality of available data, the goal was to develop a rather open and flexible approach that integrates existing regional, national or international expertise, while being based on a consistent concept and on systematic data input.

According to C.A. Mücher *et al.* (2003, p. 16) the challenges for further research can be summarised as follows:

- Explicit end-user orientation (biodiversity; cultural heritage; land use policy; landscape policy) at an international level.

- Flexibility to be guaranteed by a well structured GIS containing the necessary information layers that can be approached easily to deliver tailor-made products at various scales, as well as easy updates and improvements; flexibility in data interpretation and/or aggregation/generalisation of results.
- A commonly shared conceptual framework.
- Methodological transparency: what data are used, what is qualitative (nominal), what is quantitative information (rank order, ratio). Being applied in a systematic way (so without inconsistencies across borders due to hidden national differences).
- Sufficient support from scientists and policy-makers in order to guarantee that data are really accepted and being used.
- Moving away from a subjective, intuitive and qualitative approach towards a more formal, objective and quantitative standardised system.

2.5.2 Selection of European data sets

At first user requirements and possible target groups have been identified. Then it was necessary to get an overview over the availability of European-wide unique data sets. These data sets were reviewed in order to find out those which are suitable for the development of the European landscape typology and map. The important data sources have been described in terms of major characteristics, motivation to use, data availability and importance compared to data availability based on expert judgement.

According to the project definition, landscape character is considered to reflect the functional hierarchy that marks the relation between abiotic, biotic and cultural phenomena. Following this rational, the following data sets have been systematically reviewed: climate, geology, geomorphology and topography, hydrology, soils, natural vegetation, fauna, land use, and landscape patterns. This review was based on the analysis of existing national landscape typologies which have been considered as key references for the development of a European approach. Since the work on LANMAP had started clearly before ELCAI, this initial national review was only based on a subset of national examples which included landscape classifications from the Netherlands, England, Scotland, Germany and Hungary. Despite the short-comings of such a selective first analysis, the

TABLE 2.3. Construction and identification of the European landscape typology.

Data layer	Types	Identification
Environmental zones (first capital letter)	1 Arctic	K
	2 Boreal	B
	3 Atlantic	A
	4 Alpine	Z
	5 Mediterranean	M
	6 Continental	**C**
	7 Anatolian	T
	8 Steppic	S
Digital terrain model (first lowercase letter)	**1 Lowlands (<0 m–100 m)**	**l**
	2 Hills (>100 m–500 m)	h
	3 Mountains (>500 m–1,500 m)	m
	4 High Mountains (>1,500 m–2,500 m)	n
	5 Alpine (>2,500 m–5,000 m)	a
Parent material (second lowercase letter)	**1 Rocks**	**r**
	2 Sediments	s
	3 Organic materials	o
	4 unclassified	x
Land use (combination of the third and the fourth lowercase letter)	1 Artificial surfaces	af
	2 Arable land	**al**
	3 Permanent crops	pc
	4 Pastures	pa
	5 Heterogeneous agricultural areas	ha
	6 Forests	fo
	7 Shrubs and herbaceous (semi-)natural vegetation	sh
	8 Open spaces with little or no vegetation	op
	9 Wetlands	we
	10 Waterbodies	wa
Masks	URBAN, built-up areas	
	FLATS, intertidal flats	
	WABOD, waterbodies	

resulting set of three main criteria (namely climate, geomorphology and land use) confirmed widely established expert views (Klijn *et al.* 1999; Klijn and Vos 2000; Wascher 2000).

For a European landscape classification the following core data sets have been selected:

1. Climate based on the stratification of Europe in Environmental zones (see Map 2.2 in this report).
2. Topography in form of the digital elevation model GTOPO30 with 1-km resolution of the USGS.
3. Parent material as a subset of the European Soil Database on the scale 1:1 million of the European Soil Bureau, re-sampled to 1-km resolution.
4. Land use of the CORINE land cover database on the scale 1:100000, re-sampled to 1-km resolution.

Since reliable European maps on (surface) geology and geomorphology were not available, information on topography and parent material were chosen as an adequate substitute. These four core data sets are the basic input information for a European landscape map (LANMAP2).

2.5.3 Methodology

For the delineation of European landscapes the software eCognition (DEFINIENS Imaging GmbH Munich, Germany) was used. It is an object-oriented image classification software. The image classification is based on attributes of image objects rather than on the attributes of individual pixels. Image classifications with eCognition have a higher classification accuracy and a better semantic differentiation than conventional methods. The classification is made on the base of contiguous, homogeneous image regions which are generated by initial image segmentation.

Before the segmentation in eCognition the four input data sets environmental zones, topography, parent material and land use had to be simplified to a limited number of relevant thematic classes.

The original 13 environmental zones of Europe were aggregated to eight types of environmental zones (see Table 2.3). The digital elevation model GTOPO30 was aggregated to five altitude classes representing five elevation types. The originally 127 classes of the data layer parent material have been critically reviewed, grouped into 16 classes and finally reduced to the four classes (see Table 2.3).

The land use data layer was derived from the CORINE land cover database. The originally 44 thematic classes at the third level, 15 classes at the second level and five classes of the first level have been aggregated to 10 classes for the typology.

After reducing the number of thematic classes the three core data layers topography, parent material and land use were stacked into one RGB (Red-Green-Blue) colour composite as an ERDAS Imagine image file which created the appearance of a 1-km resolution satellite image.

In a next working step this RGB colour composite was segmented in a specific way with the eCognition software which allows adjusting several parameters. The most important parameters are the scale parameter and the weight factor for the individual layers. If the scale factor has a low value (e.g. 15) the segmentation is very detailed. A high scale factor (e.g. 100) provides a very coarse segmentation. The weight factor of 0 means that the data layer will not be considered in the segmentation process, when the factor is set to 1 the layer counts completely. The image was segmented on a first level using topography and parent material only which was considered to be a fixed matrix. On a second level the (landscape) segments were further subdivided on the basis of land use. Per mapping unit the dominant environmental zone, topography, parent material and land use class have been calculated and attached as an attribute to the database.

The final segmentation result can be exported directly to an ArcView shape file.

2.5.4 The landscape typology

After finishing the segmentation the landscape units in form of individual segments had to be classified concerning their attributes. The objective was a typology for European landscapes.

In addition to the reduced thematic classes for each data layer, the eight classes of climate, the five classes for the digital elevation model, four classes for the parent material and 10 classes for land use, three classes for urban, marine and freshwater landscapes were directly derived from the land use layer because of the lack in the soil data base. Theoretically there are (8*5*4*10) + 3 = 1,603 combinations possible but in reality finally only 375 combinations occur representing the new European landscape types.

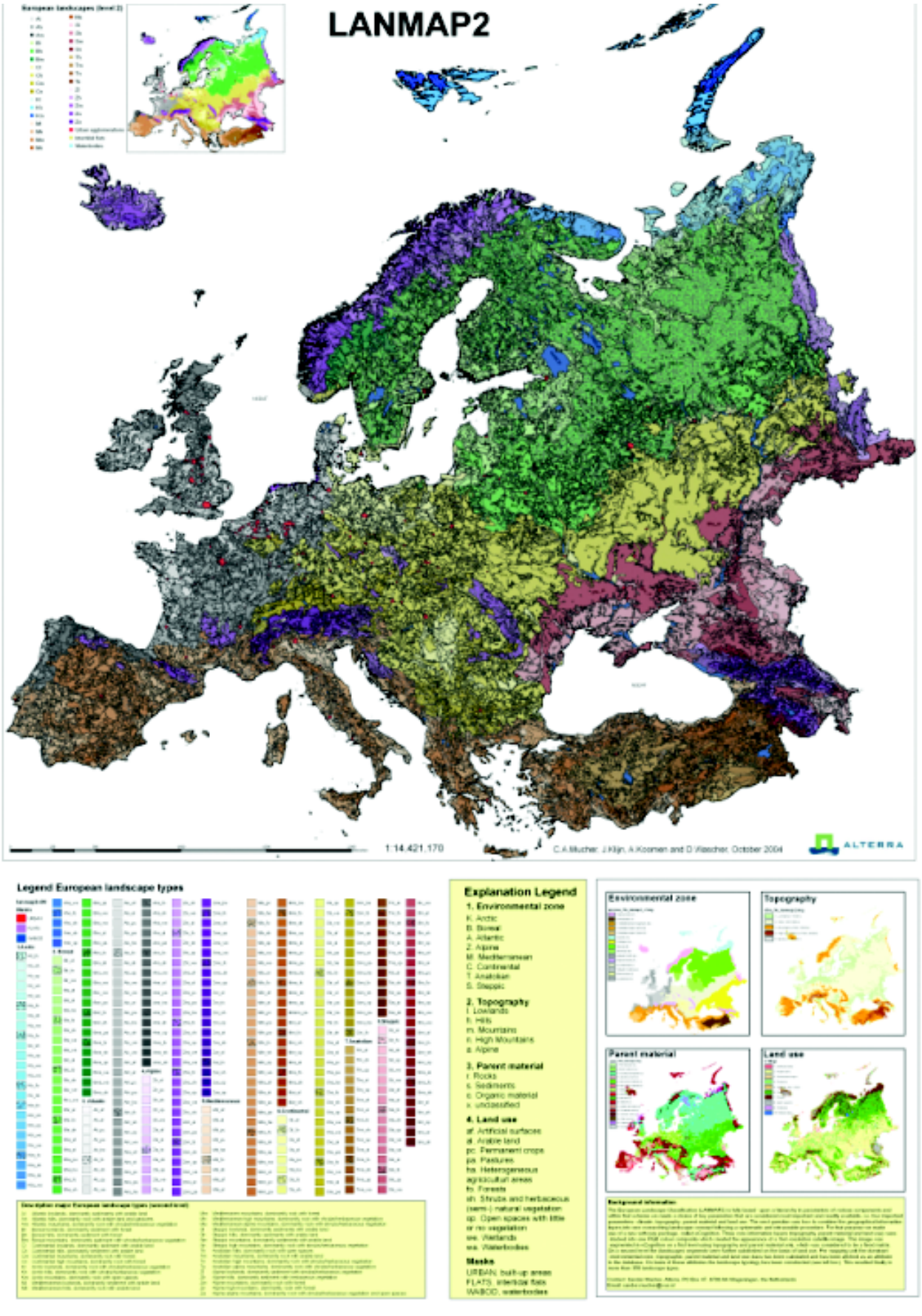
Each landscape type is characterised by a five-digit code consisting of one capital letter and a combination of four lowercase letters. The capital letter represents the environmental zone, the first lowercase letter the elevation type, the second the type of parent material. Then separated by an underline the land use type follows. For example the landscape type Clr_al is composed of Continental (C), Lowlands (l), Rocks (r) and Arable land (al) (see Table 2.3).

The source for information of urban landscapes is the CORINE land cover data set. Only the larger urban agglomerations have been selected by using a 5 km by 5 km majority filter in ERDAS imagine. This layer was integrated into the landscape map.

Finally the following post-processing steps were made to upgrade the European landscape map:

- adding major urban areas (lc_1km_urban_majority_5km)
- aggregation of adjacent polygons with the same landscape type (normal dissolve)
- removing small polygons by combining them with larger adjacent polygons using arcscript (dissolve_adjacent_polys)

MAP 2.18. European landscape typology map LANMAP2. (Mücher *et al*. 2005)



- using option dissolve with smallest adjacent polygon and threshold of 50 km^2 (5,000 ha).

2.5.5 Results

The result of the whole identification and classification process is a European landscape typology map, the so-called LANMAP2 shown in Map 2.18. The map composition consists of different parts, the map title on the top, the European landscape typology map itself in the centre, and in the upper left corner a small scaled cartographic representation of the European landscape zones (level 2). Below the map you find the legend with explanations of the cartographic symbols used for representing the map content.

The map legend is well structured and consists of three parts. The first part contains all 375 European landscape types sorted into the eight environmental zones. Besides the major European landscape types (second level) are shortly described in a table below the landscape types. The letter symbols to identify single landscape types are explained in the second part. In addition the four input data layer environmental zones, topography, parent material and land use are cartographically represented in the lower right corner as the third part of the legend. This is a good idea because the map user can get an impression of the input data layer and an overview over the spatial distribution of each criterion within Europe. Some background information about the used methodology completes the map legend.

The map content is based on a clear and understandable methodology explained in the chapters above. The landscape map is an ArcView shape file with about 14,000 landscape mapping units of which more than 12,000 are larger than 2,500 ha.

All landscape types are cartographically represented by a borderline, a colour fill and the five-digit code. Along the borderlines of the landscape units the pixel-based structure of the map with a resolution of 1 km x 1 km is visible. The used cartographic method is the method of qualitative area symbolisation. That means different area colours are used for the presentation of the eight environmental zones. Concerning the colour selection it could be mentioned that 375 landscape types can't be cartographically represented by 375 colours where each is so different from the other that they all can be recognised without any problems by the eyes of the map user. Based on this experience for the representation of the environmental zones the principle of the so-called indicative colour was realised. That means different intensities of a indicative colour (in this case blue, green, grey, violet, brown, olive green) are used for one environmental zone. The other two criteria parent material and land use are not directly but indirectly cartographically represented as a part of the digit code of each landscape type in black.

Within the indicative colours, for example blue for arctic, the colour intensity increases more or less in dependence on the change of topography type and/or the change of land use type.

By means of a colour range from light to dark blue, 29 landscape types of the artic zone are represented. The 71 landscape types of the boreal zone are depicted in a range from light green to dark green. The 56 landscape types of the Atlantic zone appear in different shades of grey. For the 62 landscape types of the alpine zone a colour range from a light violet to a dark violet was used. The 60 landscape types of the Mediterranean zone are represented in a colour range from a very light brown to a dark brown. For the 52 landscape types of the continental zone a colour range from a very light olive green to a dark olive green was used. The 27 landscape types of the Anatolian zone are represented in different brown tones. The colours for the 42 landscape types of the steppic zone span between a light pinkish brown to dark brown.

The mask for the urban layer is represented in red, the flat layer in violet and the water body layer in dark blue. The continental border in form of a vector layer is shown in black. Along the coast line the differences between this vector layer and the pixel-based layer of the thematic content are visible.

In total with this map a first computer-based approach for a European landscape classification and typology was realised. For the map unique European-wide available data layers have been analysed and assessed with respect to their use. So the distinctions between national data sets and national methodologies and problems of comparability were excluded. The used input data sets are of high spatial resolution and accuracy.

The methodology is more transparent than the methodology of Meeus. New techniques in object identification developed by the Alterra research team provide new and detailed results in the field of landscape classification and typology. The results are more objective because of the used computer based methods but the expert knowledge is also needed for the development of such a scientific method. With the typology and map an updated representation of European landscapes is delivered and a great step has been done towards the availability of a uniform landscape map for different scientific and practical purposes.

2.6 Conclusions

Although a number of countries have developed typologies for characterising landscapes, the examples illustrate that existing national approaches vary in terms of their methodologies and objectives. From the European perspective, the existing approaches are too partial and too incongruent to allow a purely additive combination or agglomeration into one unified concept. Even if such a clustering of existing maps would be technically possible, newly arising European policy objectives are likely to differ substantially in terms of scale and contents from (earlier) national objectives. In order to be instrumental for existing and future European policy implementation, a future European landscape classification needs to be adequate in terms

of scale (manageable number and size of units), in contents (covering all relevant landscape types in the range from natural–rural–peri-urban and urban) and in methodology (transparent, GIS-compatible and linking up with a wide span of environmental data at the European level).

In comparison to geographical references developed in the field of biogeography and ecology it is only recently that efforts have been undertaken to classify landscapes at the international level. Meeus' landscape typology for the report 'Europe's Environment: the Dobříš assessment' (Stanners and Bourdeau 1995) undertook a first attempt to describe the character and illustrate the geographic distribution of landscapes in a pan-European context. Ten years later and in the light of the newly arising policy needs, international experts have undertaken a methodologically state-of-the-arts approach towards European landscape classification by developing the digital LANMAP2 (Mücher *et al.* 2003, 2005). This map offers a large level of detail in terms of spatial explicitness for 14,000 mapping units as well as access to the more specific and more comprehensive original datasets.

After looking at the biogeographic context, the next step in developing a European landscape classification and map is certainly the analysis of important issues such as geo-morphological information and data on human land use. Both factors are considered to be of substantial importance in the identification of commonly recognisable landscape types. It is at this level that a (European) top-down approach is likely to meet the national process: landscape typologies developed by individual countries provide the valuable reference for validating and adjusting the international draft concepts. As a result, the national concepts should be 'nested' with a hierarchical system of scales that build upon each other: regional, national, and European units should be part of one and the same methodological system.

3 Methodological review of existing classifications

Geoff Groom

3.1 Introduction

"Landscape Character Assessment" (LCA), as the term has been used within the context of ELCAI, has representation around Europe by many individual examples. Moreover, in the way that LCA is understood within this project, it involves the use of scientifically sound tools for classification of landscape types (LC-Types) and mapping of associated landscape type areas (LC-Areas). It is therefore imperative to make review of European LCA work that gives due consideration to its scientific and technical properties. The scientific and technical review, as the part of the project where the major examples of LCA have been brought together, has in particular represented the major set of reference material to be used through the project. The full set of objectives of the scientific and technical review has been to:

- collect a set of summary European LCA example reference data;
- provide a scientific basis for wider LCA developments;
- help clarify LCA issues; and
- act as a catalyst for LCA discussion.

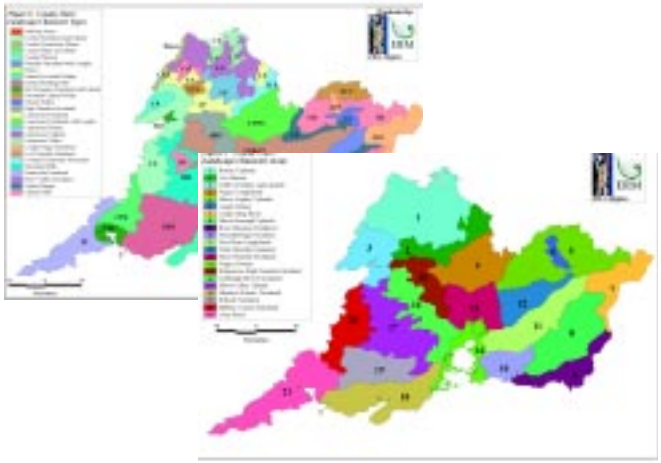
Throughout the review process three questions have been borne in mind:

- What can be considered as the state-of-the-art of LCA in Europe?

FIGURE 3.1. Examples of map products from some of the reviewed European examples of LCA work.

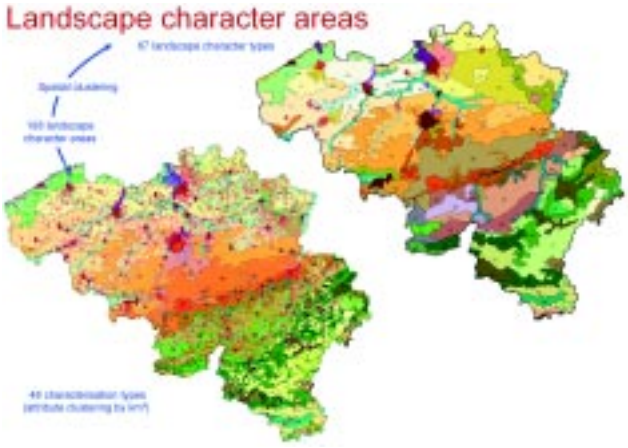
Hungary: in the 1980s experts' interpretation was used to map 35 "mezzo-landscapes".

Ireland: in 1999 and 2002 LC Types and LC Areas were mapped for County Clare.



Spain: the Spanish Landscape Atlas with 116 landscape types was published in 2003.

Belgium: recent Belgian work has mapped 198 LC Areas that comprise 67 LC Types.



Sources: Hungary: É. Konkoly-Gyoró, Dept. of Environmental Sciences, University of West Hungary. Ireland: ERA-Maptec (Eilis Vaughan), ERM-Ireland (Ruth Minogue). Spain: R. Mata Olmo and C. Sanz Herráiz (Dirs.) (2003), Atlas de los Paisajes de España. Ministerio de Medio Ambiente de España, Madrid, 683 p. Belgium: Veerle Van Eetvelde, Marc Antrop, Marjanne Sevenant, Geography Dept., Ghent University.

- How may LCA examples provide input to European LCA integration?
- Do LCAs address real landscape situations and applied needs?

The full list of European examples of LCA work that was included in the review work is given in Table 3.1, and Figure 3.1 presents images from some of these examples. (See Map 3.11 for the number of examples of LCA work reviewed for each country in Europe. Summary texts on each reviewed example are presented in Section 2.4.2).

The major need was to have a good representation of examples of European LCA work. The principle method used to source input to the review process was elective submission of LCA examples by project partners. Input was mainly made through completion, by project partners of a standardised questionnaire (see Annex I), eliciting information on the key aspects of example LCAs. The information provided by the questionnaires was supported by presentations on LCA examples made by project partners at the project meeting held in Utrecht in May 2003, together with the associated discussions and follow-up liaison with project partners to clarify information, study of reports, papers and websites relating to specific LCA examples.

A coding nomenclature has been adopted to refer to the individual LCA examples (see Table 3.1); the coding is based upon the nation state that the examples relate to and uses the two-letter ISO 3166 country codes (http://www.iso.org/iso/en/prods-services/iso3166ma/02iso-3166-code-lists/list-en1.html#gk). The additional code "pe" is used for four pan-Europe examples, i.e. examples that cover more than one nation-state.

A subset of the reviewed set of national European LCA examples has also been used within WP4 of ELCAI for comparison with the recent European landscape typology and map "LANMAP2" (referred to as "pe2" here). In Table 3.1 the examples that have been used are indicated with a hash (#) symbol in the first column. (The coding nomenclature used in this WP1 report is also used for WP4.)

3.2 Data analysis

The set of European LCA examples gathered for the review covered a broad range of specific LCA activities that reflected different understandings of "LCA" and objectives for LCA work. It was essential therefore for the review to initially establish the major mode of LCA work expressed by each example. The four modes used for this first stage of the review are described in the Results section, together with the breakdown of the set of examples according to the modes. Following this initial filtering analysis was undertaken in terms of the following three key aspects:

- The structural properties of the topologies and/or mappings of landscape character units produced by each example, such as in terms of their use of class hierarchies, and the thematic and spatial uniqueness of defined units.
- The factors considered as forming the basis for landscape character unit typology and/or mapping. Factors are grouped according to their key aspects, namely, biophysical, anthropogenic ("cultural"), experiential ("sense of place") and stakeholder input orientated factors.
- The data processing, classification and other technical methods used to undertake the LCA work, such as use of interpretative or analytical, interactive or automated methods.

More detailed explanations of each of these aspects are given within the Results section.

For some examples it was also not possible to review all three of these aspects due to the stage of development reached by the example. Thus, examples of LCA work that are, at present, mainly conceptual were not amenable to examination of the structural properties of outputs that have yet to be produced. In addition, it is not always possible to analyse the spatial properties associated with examples of LCA work that represent an open framework for LCA, since in this review this aspect is defined in rather simple, categorical ways. The extent to which it has been possible to review each of the three key aspects for each LCA example is shown in Table 3.2. It has been possible to analyse most of the reviewed LCA examples in terms of all or at least two of the three aspects.

3.3 Results

The analysis of the examples required more time and effort than originally expected, due to the diversity represented by the examples and the differences in the ways information describing examples was presented to the review. This latter complication was in spite of the use of the standardised questionnaires to serve as a basis for standardised review data. However, the extended analytical process was also beneficial to the review and the project in general in that it created a need for detailed examination of many key aspects of LCA, which has increased the project's overall understanding of the topic.

The questionnaire used for input of LCA examples to this review provided a relevant basis for standardisation and completeness of data across the set of examples. However, in the responses to this questionnaire not all the examples are represented by the same level of detail. In some cases information on specific aspects of an LCA example are omitted or only lightly presented. It has not been possible within this work to follow-up, by personal contact to partners or by Internet/publication research, all of these cases of absent information and incomplete detail.

3.3.1 Modes of LCA work

The initial aspect considered by the review, that of the general mode of each of the LCA examples is central to the development of the review, providing an initial sorting of the set of examples. The expressions of LCA work in the submitted set of LCA examples was sorted in terms of the following four modes:

TABLE 3.1. ELCAI reviewed examples of European LCA work.

ELCAI Code	Title as given by questionnaire respondent or in other source material	Associated publications/useful references (see Section 2.4.2 for websites)
AT1	ALMAP89 – Austrian Cultural Landscape Mapping 1989	Fink *et al.* 1989
AT2 #	SINUS – cultural landscape types	Wrbka *et al.* 1999; Szerencsits *et al.* 1999
AT3	ÖR7 - Sauwald / Mühlviertel / Böhmerwald	Vierlinger *et al.* 1998
AT4	National approach … used for BD assessments etc.	
BE1	The Landscape Atlas, Flanders	Antrop 2002
BE2	Ecodistricts, Flanders	Sevenant *et al.* 2002
BE3	Traditional Landscapes of Flanders	Antrop 1997
BE4	Landscape Character Map[1]	
BE5	Biological Valuation Map	De Blust *et al.* 1994
BE6	Les Territoires Paysagers de Wallonie	Feltz *et al.* 2004
BE7 #	Landscape characters of Belgium[1]	Van Eetvelde *et al.* 2005
CH1	Landscape Concept Switzerland	Walder and Glamm 1998
CH2	Indicators for sustainable landscape development/ Switzerland Landscape 2020	
CH3	Swiss Landscapes of National Importance	
CH4 #	Landscape quality of Mobilité Spatiale Regions	
CZ1	LCA for public administration	Michal 2005
CZ2	LCA (Methodology)	Bukacek and Matejka 1997
CZ3	Landscape values in the city of Pilsen master Plan	
CZ4	Landscaping Assessment	
CZ5	National mapping[1]	
CZ6	Concept of Lipsky and Kolejka 1997[1]	
DE1	Environmental monitoring[1]	
DE2	Geographical characterisation: Mecklenburg-Vorpommern[1]	Umweltministerium Mecklenburg-Vorpommern 2003
DE3	Classification of natural landscapes in Germany	Meynen *et al.* 1962
DE4	Types of natural region in the former GDR	Richter 2005
DE5	Natural areas and natural area potentials of Saxony	Bastian 2000
DE6	Ecological Area Sampling (EAS) in Germany	
DE7 #	Distribution and Threats of German Landscapes	Gharadjedaghi *et al.* 2004
DK1	Cultural landscapes in Denmark	Nordic Council of Ministers 1987
DK2	Valuable landscapes in the Roskilde region	
DK3	Landscape Character Assessment in Denmark ("OHC")	
EE1	Geographical localities of Estonia	Granö 1929[2]
ES1 #	Spanish Landscape Atlas	Mata Olmo and Sanz Herraiz 2003
FR1	Landscape atlases (Lower Normandy as an example)	Brunet and Girarden 2001
FR2	Territorial project (Limousin as an example)	
GB1 #	Countryside Character Initiative (England)	Swanwick 2002
GB2	Scottish national programme of Landscape Character Assessment	Swanwick 2002; Julie Martin Associates and Swanwick 2003
GB3	Northern Ireland Landscape Character Assessment	Environmental Resources Management 2000
GB4	Landmap (Wales)	
HU1	Taxonomic distribution of natural landscapes	Pécsi 1989
HU2 #	Landscape Types	Marosi and Somogyi 1990
IE1	Landscape Character Assessment in County Clare	ERM Ireland Ltd 2004
IT1	Italian national classification of landscape spatial configuration	
NL1	Ecological Landscape indices	Hoogeveen *et al.* 2000; van Eupen *et al.* 2002
NL2 #	Nota Landschap 9 Landschapstypen	Farjon *et al.* 2002
NL3	Histland	
NL4	VIRUS – Visual Spatial Information System	Hoogeveen *et al.* 2000
NO1 #	The Norwegian landscape reference system	Puschmann 1998
pe1	European Landscape Map of Meeus[1]	Meeus 1995
pe2	European Landscape Character Map – LANMAP2	Mücher *et al.* 2003
pe3	ENVIP-Nature	
pe4	LEAC – Dominant Landscape Types[1]	
PT1 #	Landscape characterisation in Portugal	Pinto-Correia *et al.* 2003a; Pinto-Correia *et al.* 2003b
PT2	Landscape Units – Guardiana NP	
SK6	Landscape Atlas of the Slovak Republic[1]	

= Examples that have also been used within WP4 of ELCAI.
1 Details were provided as a presentation, without a checklist.
2 Granö's main LCA related work was applied to Estonia, but similar analyses by Granö were also made for Finland.

TABLE 3.2. The extent that each LCA example could be reviewed in terms of three main review aspects. Rows with all columns white indicate examples that could not be analysed apart from in terms of their mode (see Table 3.3).

LCA	Structure	Factors	Method	LCA	Structure	Factors	Method
AT1				DK1			
AT2				DK2			
AT3				DK3			
AT4				EE1			
BE1				ES1			
BE2				FR1			
BE3				FR2			
BE4				GB1			
BE5				GB2			
BE6				GB3			
BE7				GB4			
CH1				HU1			
CH2				HU2			
CH3				IE1			
CH4				IT1			
CZ1				NL1			
CZ2				NL2			
CZ3				NL3			
CZ4				NL4			
CZ5				NO1			
CZ6				pe1			
DE1				pe2			
DE2				pe3			
DE3				pe4			
DE4				PT1			
DE5				PT2			
DE6				SK6			
DE7							

TABLE 3.3. The mode of each reviewed LCA example.

	Mode					Mode			
LCA	Concept	Descriptive	Definition	Open	LCA	Concept	Descriptive	Definition	Open
AT1					DK1				
AT2					DK2				
AT3					DK3				
AT4					EE1				
BE1					ES1				
BE2					FR1				
BE3					FR2				
BE4					GB1				
BE5					GB2				
BE6					GB3				
BE7					GB4				
CH1					HU1				
CH2					HU2				
CH3					IE1				
CH4					IT1				
CZ1					NL1				
CZ2					NL2				
CZ3					NL3				
CZ4					NL4				
CZ5					NO1				
CZ6					pe1				
DE1					pe2				
DE2					pe3				
DE3					pe4				
DE4					PT1				
DE5					PT2				
DE6					SK6				
DE7									

- The LCA work is so far made only at a **conceptual** level, such as part of guidelines for landscape assessment. Within these examples the range of criteria considered for LCA can be large, given the 'brain-storming' possibilities of this type of activity, and linkages to evaluation, judgements, policy and planning issues tend to be strongly expressed.[3]
- Assessment of the landscape character of otherwise spatially delimited areas, such as administrative units, i.e. the LCA is mainly **descriptive**.[4] One form taken by these mainly descriptive examples of LCA is application of multiple layers of landscape character information and interpretation to spatial units, largely free of any *a-priori* synthesis. Working in that latter way, the range of factors that can be brought into the LCA process is very broad. More fundamentally, the range of factors used may incorporate aspects of landscape evaluation and judgement. Conversely, another possibility for descriptive LCA work is that it can aim to 'organise' (i.e. to synthesise) a set of otherwise delimited spatial objects according to notions of landscape character.
- The 'classic' form of LCA operation is one of **definition** of distinct Landscape Character Types and/or Landscape Character Areas with at least the potential for these to be mapped on the basis of the criteria used for their definition. The significant property of this mode of LCA work is that LCA spatial mapping units are delimited by consideration of LCA issues rather than by other ('extra-LCA') mapping processes, such as the delimitation of administrative units[5]. In general this type of LCA work can be regarded as a classification and mapping process within the standard scientific method. As such, an important characteristic of this mode of LCA work is that the selection of criteria considered as defining LCA is constrained by the need for (potential) spatial integration of these factors within the classification and mapping processes.

3 Categorisation of examples as this mode represents just the current state of the example, as expressed through the material available to the review. It is possible that subsequently a conceptual LCA will develop and be implemented as one of the other three modes.

4 It is necessary to note that these descriptive forms of LCA are not fully accommodated by the LCA definition statement drawn-up as a guide for the ELCAI project.

5 This property is however open to some interpretation, with some cases where the LCA units are delimited largely 'freehand', cases where they are constrained by a raster of a certain size and other cases where they are constrained by local (i.e. "small") otherwise-delimited spatial units such as parishes.

- The definition, mode of LCA work noted above is based around the premise of definable, "fixed" Landscape Character Types and/or Areas, with the defined LCA types and mapped units providing a basis for a wide range of applied landscape work. However, LCA can also take, as the basis for typology and mapping, a more overtly **open** approach, providing a means for various LCA orientated typologies, mappings and/or visualisations of landscape character factors. These operations can provide the potential for different purpose-driven typologies and mappings or visualisations of landscape character. It is possible for the primary outputs to be related to aspects of "landscape" other than expressions of the landscape character, such as, for example, mappings of various landscape patterns, processes and/or sustainability indicators. To some extent open LCA work can be considered as a flexible version of the 'descriptive LCA with synthesis' type of LCA work that was noted above. That is particularly the case where their base spatial unit is a set of pre-defined polygons, rather than nominal spatial units such as raster cells. However, in this review open LCA examples are more simply characterised by the overt flexibility of their methods and the output formats of their LCA products.

The analysis of the LCA examples in terms of their mode is presented in Table 3.

3.3.2 The structural properties of the topologies and/or mappings of landscape character units

The set of LCA examples in this review vary considerably in the structural properties of their LCA outputs, i.e. the ways that they use hierarchies, the scales they relate to and the spatial/geographic characteristics of mapped Landscape Character Types or Areas. It is important to include consideration of the structural aspect of the outputs within the review in order to comprehend fully the range of LCA activities across Europe and for consideration of LCA data harmonisation possibilities. The most marked variations in spatial properties of LCA products may be expected to be associated with the definition mode of LCA work since these are unconstrained by existing spatial units. LCA work that is open is likely to have rather simple structural properties. However, LCA examples that have an open mode are also generally less amenable to analysis of structural properties of the LCA output, since flexibility in the types of associated products is often an intrinsic characteristic of such LCA work. Consideration of the structural properties of LCA products is not meaningful for examples of LCA work that are mainly conceptual.

The properties through which this aspect was analysed are described below:

- Whether the LCA defines unique character areas (such as "The Yorkshire Dales") or more generic character types (such as "limestone plateau landscape"). This property can vary between the higher and lower levels of a hierarchy and in the case of some LCA work both types and areas have been defined and mapped (e.g. IE1).
- Whether the mapping of each LCA type or area comprises a single topographic polygon (e.g. just one "feature" in an ESRI shape) or a distributed set of polygons. As with the previous factor, this property may vary between the higher and lower levels of a hierarchy.
- The number of character type classes and mapped polygons at each level and total number of actual mapped units.
- The mapping scale with which the LCA work is associated.
- Whether the scope of the LCA is the whole of a continuous area, such as an entire country or region or just certain locations with a more extensive area (matrix). In the latter case the LCA process does make any statement concerning the character of the matrix.

The first two properties tend to be associated. Thus, Landscape Character Types (LCTs) are frequently considered as distinct types of landscape that are relatively homogenous in character and the same LCT may occur in different parts of the country (Julie Martin Associates and Swanwick 2003). Conversely, LCA work resulting in a set of Landscape Character Areas is very likely to be associated with a mapping that comprises a single polygon per Landscape Character Area (see for example the Countryside Character areas of England, GB1). However, for analysis of actual LCA examples this association cannot be considered purely in a simplistic way. For instance, it is not impossible that a Landscape Character Area could *de facto* comprise a set of geographically close, but not co-joined upland map units, or include a mainland map unit together with some islands. Furthermore, as is very relevant for Europe, two separate mapping units of a Landscape Character Area that lie along a nation state's border might in fact form just one mapping unit if the landscape of the adjacent nation state was also taken into consideration. In this analysis it is the principle behind the typology and mapping that is taken for interpretation of the first property, i.e. whether or not the level in the typology hierarchy primarily addresses character areas or character types. For the second property it is the actual mapping practise that has served as the guide for the analysis, i.e. whether typology units relate to just one or to more than one mapping units, irrespective of the reason why either might be the case.

If an LCA is made in terms of unique character areas at level-1 (i.e. the largest spatial units) of a hierarchical typology, it is then only possible to consider the typology and mapping units at the lower levels as also being expressions of character area rather than character type. This is, for example, the situation in the case of the characterisation of Mecklenburg – Vorpommern (DE2).

In several cases it has been difficult to make the structural property analyses based only on the questionnaire responses or other written material. Where there has also been access to actual LCA data, such as map presentations of the LCA units it has been easier to

TABLE 3.4. Results of the review of structural properties of the LCA examples. (Yellow = not possible to review).

LCA	(numbers in these four columns refer to hierarchy levels) Ch. Areas	Ch. Types	Many PGs	One PG	Number of classes per level	Number of polygons	Map Scale	Full extent	Partial extent
AT1		1–5 ?	1–5 ?		3, 22, (23, 52, 133)[6]		50,000	x	x
AT2		1, 2	1, 2		13, 43	?, ca.16,000	200,000	x	
AT3		1–4	1–4		5, 18, 35 145	?, ?, ca.2,500	50,000	x	
AT4	1			1	9	9	1,000,00	x	
BE1						ca. 6,000	50,000		x
BE2	1, 2		1	2	12, 36	ca.21, 36	50,000	x	
BE3	(1), 2 ?		1	2 ?	12, 96		25,000	x	
BE4		1	1						x
BE5		1, 2	1, 2				10,000	x	
BE6	1, 2		1	2	13, 76		250,000	x	
BE7[7]	1		1		67	198	1,000,000	x	
CH1									
CH2									
CH3	1			1		162			x
CH4		1	1		5	106	100,000	x	
CZ1								x	
CZ2									x
CZ3									x
CZ4		3, 3	3, 3		9		50,000	x	
CZ5		1, 2	1, 2		90, 372			x	
CZ6									
DE1							2x2 km cells	x	
DE2	1–4			1–4	5, 18, ?, ?	5, 18, ?, ?	100,000	x	
DE3	1, 2			1, 2	89, 504	89, 504	1,000,000	x	
DE4		1–4	1–4 ?		5, 16, 14, 75	?, ?, ?, 2,167	750,000	x	
DE5	1, 2, 3			1, 2, 3	?,?, 1462	?, ?, 1,462	50,000	x	
DE6	1, 2		1?, 2?		6, 20		2x2 km cells	x	
DE7[8]	1b	1a, 2	1a, 2	1b	6 / 6, 24	855	200,000	x	
DK1	1			1	69	69		1	
DK2	1			1			100,000	1	
DK3		1, 2, 3	1, 2, 3				250 k–10 k	x	
EE1								x	
ES1		1, 2	1, 2		34, 116	1,263	200,000	x	
FR1	2	1	1	2	8, 75		100,000	x	
FR2									
GB1[9]		1	1		79	ca. 600	50,000	x	
GB2[9]		1, 2, 3	1, 2, 3		55, 121, 275	3,967	50,000	x	
GB3	1			1	130	130	50,000	x	
GB4		1, 2, 3, 4	1, 2, 3, 4			?, ?, 250k, 1m	10,000	x	
HU1	1, 2, 3			1, 2, 3	6, 35, 200		1,000,000	x	
HU2		1, 2, 3	1, 2, 3		4, 14, 40		500,000	x	
IE1[8]		1	1		17	27	50,000	x	
IT1[10]		1, 2	1, 2		4 / 8, 38	2,142	250,000	x	
NL1							50x50 m cells	x	
NL2		1, 2	1, 2		9, 16	113, ?	500,000	x	
NL3		1, 2	1, 2		11		100,000	x	
NL4							1x1 km cells	x	
NO1	1, 2, 3		1, 2	1, 2, 3		45, 444, ++	250,000	1–2	3
pe1		1, 2	1, 2		8, 30	ca. 150	25,000,000	x	
pe2		1	1		375	ca. 14,000	5,000,000	x	
pe3							2–50 km sq		
pe4		1, 2, (3)	1, 2, (3)		7, 21, (+21)		3x3 km cells	x	
PT1	1, 2			1, 2	22, 128	22, 128	250,000	x	
PT2	1, 2			1, 2	?, 12		100,000	x	
SK6[11]		1, 2	1, 2		13, 50	?, ?	500,000	x	

6 The number of classes at levels 1–2 relates to the national scene, but at levels 3–5 relates only to 16 study areas.
7 The character area mapping has 198 individual LC-Area map units that comprise 67 character types.
8 DE7 has two parallel layers at level-1, one representing six landscape main types, the other six landscape regions.
9 This analysis relates to the landscape character typology, not the character areas.
10 Two macro-landscape mapping methods have been tested, reducing the 38 landscape types to four and eight macro-landscape classes.
11 This analysis relates to the mapping of landscape-ecological complexes within the Atlas of the Slovak Landscape.

analyse examples in terms of these aspects and with greater confidence that the analysis made has been accurate. Where doubt remains, this is indicated by use of "?" in Table 3.4.

The analysis of the LCA examples in terms of their structural properties is presented in Table 3.4. The information given in Table 3.4 should be used only as a guide to the general structural properties of each example since, even where the source information has been adequate, it has been difficult to summarise the structural properties of so diverse a set of examples in a systematic and consistent way. For a fuller picture of individual examples please refer to the bibliographic sources (see Table 3.1) or the short descriptions of each example given in Chapter 2 of this report.

There is an additional significant structural property that is not presented in Table 3.4, mainly because the analysed examples are mostly the same in terms of this property. This property is the nature of the geographic borders between Landscape Character Areas or types, considering whether they are developed as either crisp lines or also as transition zones that can have variable widths, i.e. fuzzy units. In fact, just two of the examples explicitly develop their LCA mappings recognising and developing the latter possibility (BE3, EE1). Inasmuch as they provide a basis for variable LCA mappings the examples that have here been regarded as open LCA work also represent developments that provide a basis for fuzzy mapping. It is also important to note that the microgeochore approach, such as is developed in the example DE5, also represents a potential for fuzzy mapping since the mapped units (microgeochores) are heterogeneous reference units that represent particular patterns of basic elements (Bastian 2000).

3.3.3 The factors used to make LCA

In making analysis of the factors used in LCA work it is fundamental to distinguish between those factors that are used for making the typology and/or mapping and those factors that are only subsequently used in order to add further description or application value to otherwise defined LCA units. Those factors used solely for this later-stage activity are not the subject of this review.

In general the types of factors used to make LCA typologies and mappings can be analysed in terms of a simple set of categories, namely those that are factors relating to:

- **Biophysical dimension** (form and functioning of the landscape)
  - geology, topography, land form
  - climate
  - soil
  - vegetation
  - land cover[12]
  - wildlife and biodiversity.

- **Socio-economic–technical dimension** (human influence on the landscape form)
  - land use
  - land management practices
  - land use dynamics
  - spatial pattern of fields and settlements
  - historical, "time–depth" aspects
  - heritage related factors, such as buildings, archaeological sites
  - socio-economic aspects.

- **Human–aesthetic dimension** (human experience of the landscape)
  - 'sense of place' considerations
  - expressions of tranquillity, beauty, remoteness, etc.
  - scenic, aesthetic aspects
  - religion
  - language.

- **Policy dimension** (opinions and rights of stakeholders)
  - the general public
  - land planners and managers
  - special interest groups.

This set of factors expresses "topics considered relevant to LCA" – without consideration of how they are used by the LCA. Thus, "spatial pattern" is here taken as relating to the spatial arrangement of fields and settlements rather than spatial pattern analyses of landscape character factors in general.

The fourth of these categories of factors ("opinions and expressions of stakeholders") implies that stakeholder input has had an active role within an LCA example in defining the landscape character typology and/or map units. This therefore is not the same as mere consideration by LCA work of what factors are relevant to stakeholders, since these will be a broad set and identical or overlapping in many cases with those expressed by the other three categories of factors. Thus, an LCA example is considered as having this final category as a factor if there is within the process of defining and/or mapping LC types and/or areas direct representation of one or more stakeholders' opinions or expressions.

12 Some *de facto* land cover classes are associated with human influence on the landscape, such as where the cover is a certain type of manmade surface or cultivated vegetation; however, in this review all land cover is considered as an expression of the biophysical form of the surface, whatever its origin. Thus placement of land cover under this first set of criteria also helps avoid confusion with 'land use' that is considered here as one item in the set of anthropogenic LCA factors.

3.3.4 The methods used to make LCA

The following two dimensions have been considered for analysis of the methods used for derivation of LC types and/or mapping units:

- the degree to which the methods used rely either on human interpretation or on analytical approaches;
- the degree to which the methods use either interactive procedures or automated procedures.

Integrated, these two dimensions present four method types[13]:

- M1: simple human ('expert') interpretation
- M2: 'expert' interpretation, with support of some automated analysis
- M3: highly automated analysis
- M4: automated analysis, together with some interpretative refinement.

3.3.5 Analytical integration of LCA 'Factors' and 'Methods' – the FM matrix

As a broad approximation, both the 'factors' and 'method' aspects, as they have been considered here, can be seen as comprising a spectrum:

- The 'factor' aspect ranges from natural science components (such as geology, landform, vegetation), through social science components (such as land use, cultural factors and historic development) to

13 There can be a temptation to summarise the method as "top-down" or "bottom-up" types of approach. However, these terms have two distinct usages in relation to LCA. One usage relates to the degree of automatation (top-down) or interaction (bottom-up) within the LCA process. The other usage relates to whether the process starts by defining / mapping the largest spatial units (top-down) or the smallest spatial units (bottom-up). Unhelpfully, these two usages do not necessarily, or consistently, coincide, i.e. the smallest units can also be defined / mapped through a highly automated process, and the largest units defined / mapped with a high level of interaction. Furthermore, the "top-down", "bottom-up" terminology can also be used to describe the organisational processes involved in a development, such as whether motivation for an LCA has come from Government or from the 'grass roots'. Therefore, "top-down", "bottom-up" terminology is avoided by this review with respect to its discussion of LCA methods.

TABLE 3.5. Results of review of the factors and methods used in each example of LCA work. (Continued over).

Method	LCA factors	geology	relief, land form	climate	hydrology	soil	vegetation	land cover	nature, biodiversity	land use	land management	spatial pattern	LU dynamics	history/time depth	architecture/heritage	socio-economic	identity/sense of place	coherence	intactness	scenic/aesthetic	public	professionals	interest groups
(a) M1	BE1		■							■			□	■	■		■	■	■				
	BE5	■	■		■		■		■					■									
	CZ2	■	■		■	■	■			■		■		■	■		■			■			
	CZ3	■	■		■	■	■			■		■		■	■		■			■			
	CZ4	■	■	■	■	■	■			■	■												
	DE3	■	■	■	■	■	■			□													
	DE4	■	■	■	■	■				□													
	DK1		■	■		■				■			■										
	DK2	■	■		■	■				■		■		■	■								
	EE1[14]	■	■	■	■	■	■	■	■	■				□	□		□						
	FR1	■	■				■		■	■		■			■						□	□	□
	GB3	■	■				■		■			■		■	■		■	■	■	■			
	HU1	■	■		■	■	□																
	HU2		■	■		■	■			□													
	NO1	■	■		■		■			■	■	■											
	pe1	■	■	■		■	■			■		■		■						■			
M2	AT1[15]	■	■			■	■			■		■		■		■							
	AT3	■	■					□					□										
	BE2	■	■		■	■	■																
	ES1[16]	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
	GB4	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	IE1	■	■					■					■	■	■						■	■	■
	NL3	■	■			■								■									

TABLE 3.5 continued, Results of review of the factors and methods used in each example of LCA work.

Method	LCA factors	geology	relief, land form	climate	hydrology	soil	vegetation	land cover	nature, biodiversity	land use	land management	spatial pattern	LU dynamics	history/time depth	architecture/heritage	socio-economic	identity/sense of place	coherence	intactness	scenic/aesthetic	public	professionals	interest groups
M3	BE4																						
	DE1																						
	DE6																						
	IT1[17]																						
	NL1																						
	NL2																						
	NL4																						
	pe2[15]																						
	pe4[15]																						
M4	AT2																						
	BE6[18]																						
	DK3																						
	DE5																						
	DE7[19]																						
	GB1[20]																						
	GB2																						
	PT1																						
	PT2[13]																						
(b)	AT4																						
	BE3																						
	CH4																						
	CZ5																						
	DE2																						
	FR2																						
	pm3																						
	SK1																						

Pale yellow = analysis is uncertain
14 The set of factors used is broad, but variable since the LCA approach is open.
15 Socio-economic criteria = land ownership patterns.
16 The actual factors used is not known.
17 Land cover = CORINE LC.
18 Eighteen variables of these four criteria; spatial structure = satellite image entropy.
19 This recent German LCA uses the earlier LCA mapping by Meynen, *et al.* (1962) (i.e. DE3) as an input.
20 This analysis relates to the National Landscape Typology for England, not the character areas.

components that may be considered as lying under a 'humanities' umbrella.

- The 'methods' aspect ranges from simply interpretative or mechanistic-analytical approaches to more complex analytical and/or interactive approaches.

Thus, it is possible and useful to integrate analysis of these the factors and the methods aspects through use of a matrix presentation (Table 3.5). The 'method' axis (rows) in this matrix is designed to be singular with respect to each example of LCA work, i.e. each example should be represented by a single 'methods' row.

Conversely, the 'factor' axis (columns) is used non-singularly, that is, LCA examples can be represented by a set of non-adjacent columns.

This matrix, is designed for summary of working examples of LCA, i.e. examples that result in tangible LCA output, irrespective of whether they represent a 'descriptive', 'definition' or 'open' LCA mode. However, as it is also useful to analyse the factors that are considered relevant for LCA by examples that are merely conceptual, a second section (b) in Table 3.5 is included to present information on the factors that these LCA examples are built around. This part is also used for

those examples for which there was insufficient information regarding the methods that have been used to be able to place the example in one of the four "method" rows.

This matrix summarises the current state-of-the-art of LCA in Europe. As with any reduction of complex detail, it is not perfect, with the possibility for cases that cannot be so easily accommodated. However, it provides a useful frame for overview and analysis of LCA examples and from which analytical extensions for certain LCA cases can be easily developed.

3.4 Discussion

3.4.1 General discussion: modalities and patterns

The project's review process has captured a large set of examples of national and regional LCA work within Europe, plus some pan-European work. Moreover, the vast majority of these (43 out of 54: see Table 3.3) are examples that make mapping of landscape character units that is independent of otherwise defined spatial units, such as administrative units. A further six examples have been considered as 'open' approaches, several of which also recognise Landscape Character Assessment as unconstrained by administrative boundaries. That so many of the reviewed examples fall into these two mode categories, and in particular 'definition' mode, demonstrates that there is a strong, clear sense of the type of activity that comprises LCA. However, the examples represent a wide range of ideas and methods for actually doing LCA. Even within some countries there are many, varied examples of LCA, such as from the Czech Republic with its long and strong tradition in the distinctive central European approach to landscape study.

The modality of European LCA work is clearly one of making fixed typologies and mappings that address directly concepts of landscape character, with a strong sense of transcending existing dissections of the land. However, this modality is not necessarily the 'state-of-the-art' (in the sense of the most evolved), with several examples that have established at least the basis for far broader frameworks for undertaking environment–landscape activities including LCA (e.g. CH1, CZ6).

The small number (just two) of examples of LCA work that are tied closely to existing administrative spatial units, mainly with respect to LCA just making description of the landscape character of these units, is surprising. Even more surprisingly, these two are both from one country, Switzerland. Furthermore, neither of the other two Swiss examples represents LCA by definition of typology and/or map landscape character units. One explanation of this anomaly is possibly the strength of the canton system of administrative units in Switzerland, with inertia and resistance to work that develops alternative national dissections.

Do European LCAs have similar structural properties?
There is marked diversity in terms of the spatial and hierarchical properties of the LCA work across the sub-set of the examples for which this aspect is relevant and discernible. The issues of whether typology units are unique or generic and whether LC-Types or LC-Areas are mapped as single or many polygons has been hard to establish in some cases. Furthermore, this type of information is clearly difficult to express in simple text responses and where material included lists of types and/or maps with legends it has been easier to make this analysis. It is difficult, if not impossible, to say what the state-of-the-art is in this aspect of European LCAs, beyond stating that most examples comprise multi-level hierarchies of Landscape Character Types and/or Landscape Character Areas.

Most of the examples that do map LC-Types or LC-Areas map them as irregular polygons. The exceptions to this are five cases that make mappings in terms of raster cells; these comprise two from Germany (DE1, DE6), two from The Netherlands (NL1, NL4) and one international example (pe4). (The recent Belgian LCA work, BE7, also begins with mapping of 1-km cells, but that is just an initial stage towards production of irregular, more "real-world" spatial units.) Three of the five raster cell LCA examples have also been considered here as examples of 'open' LCA. Whether the use of a raster as the spatial base unit influences other aspects of the LCA and the character of the resulting LCA products requires further examination.

Cases with two- or three-level hierarchies are most common, but there are also several cases with four or even five levels. For most of these multi-level hierarchical examples the development of levels has proceeded "top-down" (starting with the largest spatial units, 'level-1') or "bottom-up". However, in some cases, such as NlJOS1, which has four levels, the process has begun with a mid-level, i.e. there has been both splitting and amalgamation of landscape character spatial units. The spatial and hierarchical properties of the LCA examples may be associated with the types of methodologies they have used.

The question of the coverage represented by the LCA exercises is more emphatic. In almost all cases the LCA exercise has taken a 'full coverage' approach, i.e. a landscape character statement is made for every part of a territory. Only in few cases (e.g. BE1, CH3) has the goal been to undertake LCA as part of an exercise for selection of a certain type of designated areas. In a further four examples LCA has been made for sub-regional areas, but in these cases all land in these areas has been subject to the LCA.

Is the LCA methodology and factor-set associated?
For 41 of the examples it was possible to determine the methodology used to make the LCA. The modality among these is for interpretation of Landscape Character Types and/or areas based on expertise (i.e. M1). Twenty-three examples out of the 41 have this as their primary or sole methodology (i.e. M1+M2). Just seven of these 22 cases have also involved some more automated analytical processes alongside those of expert judgement (i.e M2).

The Landmap LCA in Wales (GB4) has here been considered as an example of "expert interpretation, with support of some automated analysis" (i.e. M2), since interpretation figures significantly and computerised mapping is seen as important in handling and understanding the geographic datasets. However, in many ways this example of LCA work stands alone, since it also represents an open system for making different landscape characterisation and a sophisticated consultation process for building the database that drive the system.

Highly automated derivation of LCA types and/or areas (i.e. M3) is not as common as might have been expected given the widespread use, in some way or other, of GIS. Interestingly the use of highly automated methods shows marked geographical concentration, with three examples out of the nine representing work undertaken in The Netherlands and a further two representing work from Germany. This set broadens, numerically and geographically, when examples that combine a major use of automated analysis with some interactive refinement of the automated result are also considered, with nine additional examples from five countries (i.e. M4).

For 14 examples of LCA work it has not been possible to analyse the methodology they use for making typologies or mapping. However for eight of these it has been possible to analyse the factors that they consider relevant to making LCA (i.e. part (b) in Table 3.5).

In terms of the factors that the 49 analysed examples (i.e. (a)+(b)) use as their basis for making LCA, biophysical factors are noted for almost every example. Thus the prevalence of biophysical factors within this large set of LCA examples concurs with the observation of Mücher *et al*. (2003), drawing upon the work of Klijn, regarding a ranking of landscape factors:

Landscape ecological theory … offers motives to rank landscape phenomena in relative independent, strongly determining respectively towards dependent, less determining factors. This so-called functional hierarchical ordering puts independent and stable phenomena such as relief or geology in front, whereas aspects such as vegetation are strongly dependent and less constant.

However, cultural factors are prevalent across these examples too, with most examples including at least some aspect of the non-biophysical aspects of landscape. Most commonly this non-biophysical component is represented by consideration of 'land use'; however there is only one example (FR2) where, in terms of the cultural factors, only land use is taken into consideration. Thus, various other cultural factors, such as field, farm and settlement patterns, historical development and heritage factors are also frequently used.

A small but significant set of the LCA cases have considered more esoteric, experiential factors and stakeholder input factors in making their LCA work. In fact Table 3.5 does not represent the full situation in this respect, since it has a bias towards analysis of factors considered for deriving LC-Types rather than LC-Areas. Several examples that also included the derivation of mappings of LC-Areas (e.g. GB1, GB2, and IE1) are not analysed here in that respect, but have indeed used "sense of place" factors and stakeholder opinions in significant ways in defining and mapping LC-Areas as opposed to LC-Types.

It might be expected that there would be a simple linear relationship between the methodology used for LCA and the range and type of factors used, with older, mainly interpretative examples using mainly biophysical factors and more recent, more automated and interactive examples using a wider range of factors. This could be seen as reflecting the independent but parallel developments in the technology and datasets available, and developments in the understanding of what factors are significant to landscape characterisation. However, part (a) of Table 3.5 shows a different pattern: that of a U-curve lying over on its side, open to the right. Thus the minimalist set of factors, being mainly biophysically orientated ones, is not associated with the purely interpretative methods, but with the more purely automated methods (for example, DE1, DE6, IT1, NL1, NL2, pe2 and pe4).

3.4.2 What is the SOTA of European LCA?

The previous section has discussed the modalities and patterns observable from this analysis of the reviewed set of European LCA examples. This section takes the discussion a step further, examining what can be considered as the State-of-the-Art (SOTA) of LCA work in Europe, i.e. not merely its current status but also its apotheosis. Therefore, this section also considers the time-line represented by the set of examples, examining how the chronology of the examples represents the philosophical development and sophistication within European LCA work. In Table 3.6 the set of examples are presented in terms of the decades when the major part of their work took place.

The LCA time line (Table 3.6) shows a steady increase in the number of examples of LCA work since the 1970s, with an "explosion" of work since 1990. The one example from prior to 1950 (EE1, from the 1920s) is one specific, rather special example that comes towards the end of an earlier period, lasting about 30 years, of strong activity in the field of regional geography and landscape studies. The apparent absence of fresh European LCA work during the 1960s is notable. Several factors might be seen to have contributed to the apparent low level of LCA work between 1950 and 1990. The first half of this period coincides with the quantitative revolution and the advancement of human-environment interaction studies, but also much model-based and reductionist, experiment-orientated work within geography. The period also coincides with a retreat away from regional geographical studies, which began in the 1930s and in some countries persisted into the mid-1980s. A third factor is that it the past 10 years have seen major developments and availability on the technical means for handling, visualising and analysing many large map datasets, i.e. desktop computing and GIS.

TABLE 3.6. The decade when work on LCA examples was mainly undertaken.

Country	Decade prior	1950s	1960s	1970s	1980s	1990s	2000s[21]
Austria					AT1	AT2	
						AT3	
Belgium						BE3	BE1
							BE2
							BE6
Switzerland					CH3	CH1	CH2
						CH4	
Czech Republic				CZ4		CZ1	
						CZ2	
						CZ3	
Germany		DE3		DE4		DE1	DE2
						DE5	DE7
						DE6	
Denmark					DK1	DK2	DK3
Estonia	EE1						
Spain							ES1
France						FR1	FR2
Great Britain						GB1	
and N. Ireland						GB2	GB3
						GB4	
Hungary				HU1	HU2		
Ireland							IE1
Italy							IT1
Norway						NO1	
The Netherlands						NL1	NL4
						NL2	
						NL3	
pan-Europe						pe1	pe2
							pe3
							pe4
Portugal							PT1
							PT2
Slovak Republic							SK1

[21] 2000–2005 only

Taking the main period represented through these examples of LCA work, i.e. the period since the mid 20th century, there is a clear progression from a consideration of a narrower range of mainly biophysical factors to a consideration of the wider range of biophysical, cultural and aesthetic factors. However, this tendency is reversed if the clock is turned back to the earlier, early 20th century period of landscape assessment work. The work of Granö (EE1) exemplifies the understanding that was prevalent then of the description and delimitation of landscape that integrates natural and human, physical and more cerebral aspects.

Several European countries (e.g. Czech Republic, England, Scotland, Wales, and France) have in recent years, as well as making actual LCAs, produced detailed guidelines for the making of LCAs for regional or local extents. These guidelines cover LCA very thoroughly, describing and discussing the principles and processes involved (e.g. Swanwick 2002. The aim here is not to replicate those works, but to identify and discuss the SOTA of the more scientific and technical aspects that emerge from this review. Thus, considering the current situation a number of important features that shape the SOTA for European LCA work can be noted:

- Recognition of the difference between and significance of LCA work addressing both Landscape Character Types (LC-Types) and Landscape Character Areas (LC-Areas). Furthermore, that LC-Types relate to homogeneities, and LC-Areas can also relate to heterogeneities, i.e. distinctive patterns of landscape, such as microgeochores (Bastian 2000) that give “sense of place”.
- That the defining of LC-Types or LC-Areas and drawing of map lines by interpretation of map data by

individuals or small committees of "experts" does not represent an effective, sufficiently objective way of working.

- For definition and mapping of LC-Areas factors covering natural science, human use and human experience of the landscape is essential.
- That for mapping of both LC-Types and LC-Areas automated GIS-based techniques can provide vital assistance, but should be followed-up by interactive (field-based, workshop-based) and objective examination and refinement of the outputs.
- A recognition that LCA work addressing LC-Areas cannot be achieved through merely traditional, natural sciences working methodologies, but must also draw upon consultative and textual methods that are more familiar within the social sciences and humanities (see also the "Stakeholder Review" chapter in this report).
- A strong appreciation of the planning and land use policy contexts relating to LCA work (see also "Policy Review"). This is one of the strongest contrasts between modern and earlier LCA work (e.g. Granö 1929), in that the latter develops the academic and scientific aspects primarily, without explicit consideration of how the resulting landscape description, definition and delimitation might serve society or interact with other environmental activities. Clearly the whole context of environmental work has changed through the last 80 years.

Some questions remain

The analyses made here also leave five significant questions for further consideration:

- The role of technically sophisticated environmental database approaches, such as NL4, DE1, and DE6 within the corpus of European LCA work is unclear. These activities clearly represent significant environmental science work, but so great has been the methodological and technical development involved that effort may be concentrated on too narrow a set of factors for effective LCA. Furthermore, in these works LCA appears to be considered as a secondary aim, the primary aims being, for instance, the establishment of an ecological or environmental monitoring framework or a framework for derivation of indicators. The impression is that LCA is "something that the system can also be used for", i.e. these systems are not dedicated, not focused on LCA or at least on the contemporary, holistic understanding of LCA.
- It is clear, as noted above, that for definition and mapping of LC-Areas the factors covering natural science, human use and human experience of the landscape are essential. However, it is not so clear whether definition and mapping of LC-Types should proceed from consideration of just biophysical factors or a broader range of factors.
- Some of the central tenets of LCA are challenged by one particular example reviewed here, namely the Welsh Landmap work (GB4). In many respects this work has characteristics similar to many other recent examples of LCA work, in that it recognises a broad range of factors as relevant to LCA, the importance of consistent datasets and the usefulness of GIS to handle and visualise map data. Where it differs however is that it does not necessarily produce an integrated landscape characterisation as such; instead that is seen as optional, with greater attention placed on LCA in terms of the individual qualities that make up the landscape. Clearly therefore Landmap represents an open system for LCA, but one that is also distinct from the other open examples reviewed here (e.g. DE1, NL1). Landmap represents significant challenges to most other contemporary LCA work and what should be considered as the SOTA. This is part of a larger question of whether more open ways of doing LCA represent a useful pathway or an over-complication for end-users.
- The boundaries of mapped LCTs and LCAs are mostly presented in traditional chorological ways as crisp lines separating one unit from another. In very few of the reviewed examples is any alternative to this explicitly considered or developed. In general the examples considered here as open LCA work also represent the potential, through processing of the associated databases, for definition of core units, transition zones and non-crisp boundaries. One other modern example that represents an alternative is the work by Antrop (1997) concerning traditional landscapes in Flanders (BE3): "Borders between these landscape entities … follow landscape elements which differentiate well between the adjacent landscapes. Consequently, they can form smooth lines indicating transition zones, but can also have a detailed irregular shape when they follow an important differentiating element for example." But these are not new ideas in LCA, since the work of Granö (1929) also explicitly recognises that some landscapes have stronger distinctive character than others and that transition zones with weaker character should also be noted in mappings. This thinking represents a further significant challenge to much current LCA work.
- Many of the reviewed LCA examples stress the significance of "time depth", i.e. the historical development of landscapes, to making a LCA of the current situation. However, the temporal status of the resulting LC-Type and LC-Area definitions and mappings is largely unstated. It is generally unclear, across these examples, whether LC-Type and LC-Area definition and mapping should be considered as a one-off and static operation or something more dynamic that needs revisiting and updating as the spatial distribution and other aspects of the causal factors change. With respect to human lives and human social situations it may be justifiable to consider mainly biophysical LC-Type definition and mapping as representing a constant situation. That position is however far less tenable in the case of LC-Areas, where the use of land and the associated aesthetic characteristics reflecting human and societal behaviour patterns in many situations now changes on the time scale of just a few years. From the current SOTA of European LCA there is an audible silence regarding this important issue.

3.4.3 Do the international LCA examples represent models for an integrated European LCA?

The possibilities for pan-European LCA work are more thoroughly addressed by the chapter in this report from WP4, in which a draft conceptual framework for the development of a European landscape typology and map (LANMAP2, pe2) is analysed with respect to a set of national LCA typologies and mappings. Here some discussion is made on this issue, based upon the results from the review reported here.

It is clear that the examples of LCA work, even from adjacent countries differ markedly. Each national example has been undertaken largely independently of wider cross-border considerations. Those undertaking the work have been organisations and individuals based and orientated mainly internally. One exception has been the collaboration between LCA workers in England and Scotland in drawing-up a single set of guidelines for LCA (Swanwick 2002), but even here the actual definition and mapping of LC-Types and LC-Areas took place largely independently and followed different pathways.

Modalities in the set of European national LCAs have been noted here, but these similarities cannot cover the significant differences in actual methodologies and choice of relevant factors. Likewise, each case has associated itself with a specific set of mainly nationally focused policy issues and stakeholders (see reports from WP2 and WP3).

The geographic coverage of the set of reviewed LCAs largely reflects the composition of the ELCAI project partnership, giving a misleading impression of parts of Europe where national, highly developed LCA work has so far not been undertaken. The actual picture may differ from that, but it is indeed the case that there are some states where there has not been recent national, highly developed definition and/or mapping of LCTs and/or LCAs, such as Sweden, Poland and Greece. Whether such a *carte blanc* represents a positive or a negative situation for development of integrated European LCA work is an interesting question.

4 Geo-spatial cross-analysis of LANMAP2 and national approaches

Annegret Kindler

4.1 Introduction and objectives of WP4

The central topic of this chapter is to examine geo-spatial aspects of existing national approaches to landscape mapping in the context of the European landscape typology and map LANMAP2. Based on decision-making processes and making reference to the geographical data on national landscape maps, the compiled material has been analysed regarding its suitability for supporting the future development of a European landscape map. The analysis focuses on research requirements, data and knowledge gaps, as well as possible policy applications. The establishment of the classification and map of Landscape Character Types at the European level is the main point of reference in support of both research and policy implementation at the European and national level.

Based on the results of Chapter 3 – a review of the 'state-of-the-art' regarding Landscape Character Assessment in Europe – existing approaches in landscape mapping and typology have been further examined with the goal to determine technical and methodological requirements needed for integrating national activities into a European-wide approach.

A special focus of the investigation draws upon already existing examples of European landscape maps and typologies. These examples are reviewed concerning their content, methodology, input data, classification/ typology and borderline of landscape units, and the cartographic representation at a European level. Based on this knowledge it has to be determined how national approaches can be integrated into the further development of LANMAP2 or similar data sets. Due to the bottom-up character of this exercise, next working steps towards an improved, completed, corrected or completely new landscape map and typology of Europe had to be determined together with all project partners.

On the one hand the objective was to represent the national classifications in a cartographic form and to give an impression about their great variety concerning the kind of classification/typology, the number of classes/types, the spatial resolution, and the degree of generalisation and so on. On the other hand the distinctions between the national and the European landscape classification have been addressed by means of a geo-spatial comparison between the national approaches and LANMAP2 (Mücher *et al.* 2003; 2005).

Therefore the ELCAI-partners were asked to provide their national information and expert judgement in contribution to this assessment. A national landscape classification is only available in eleven of the fourteen participating countries: Norway, United Kingdom, Belgium, The Netherlands, Germany, Switzerland, Austria, Czech Republic, Hungary, Portugal and Spain. Currently Denmark, France and Ireland do not have a national landscape classification/typology. The national landscape maps that have been further assessed in this chapter often repressent just one of several from a country, but the aim has been to work with the most recent, most complete mapping.

Figure 4.1 provides an overview over the existence and availability of national classifications in the participating countries of the ELCAI project.

4.2 The development of a harmonised digital database

To achieve the above mentioned aims several working steps had to be undertaken. Ten partners provided their national classifications for further investigations. The Czech national classification exists but it was not available in digital format during the project implementation. Besides the digital data, some partners provided national mapping data in form of a jpeg or tiff file.

MAP 4.1. Overview of the national landscape classifications/ typologies.

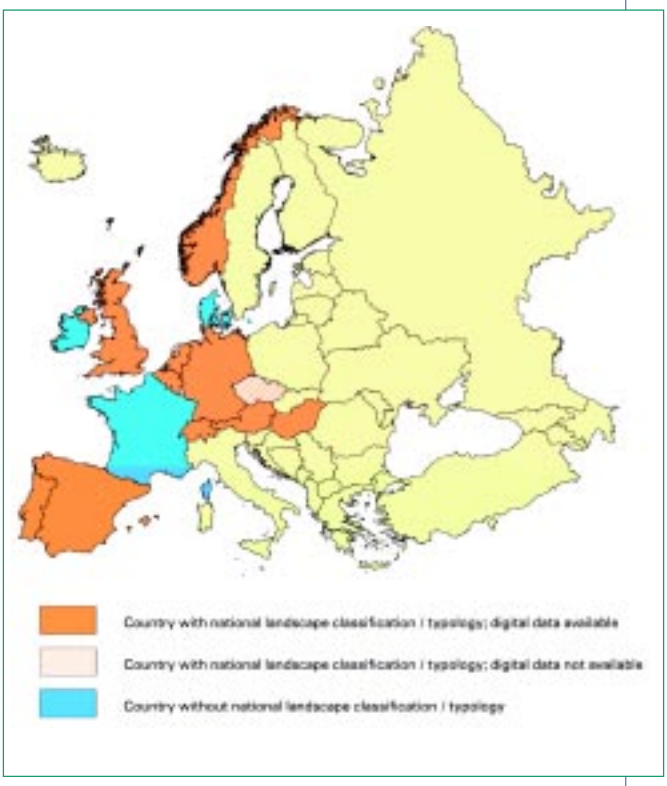
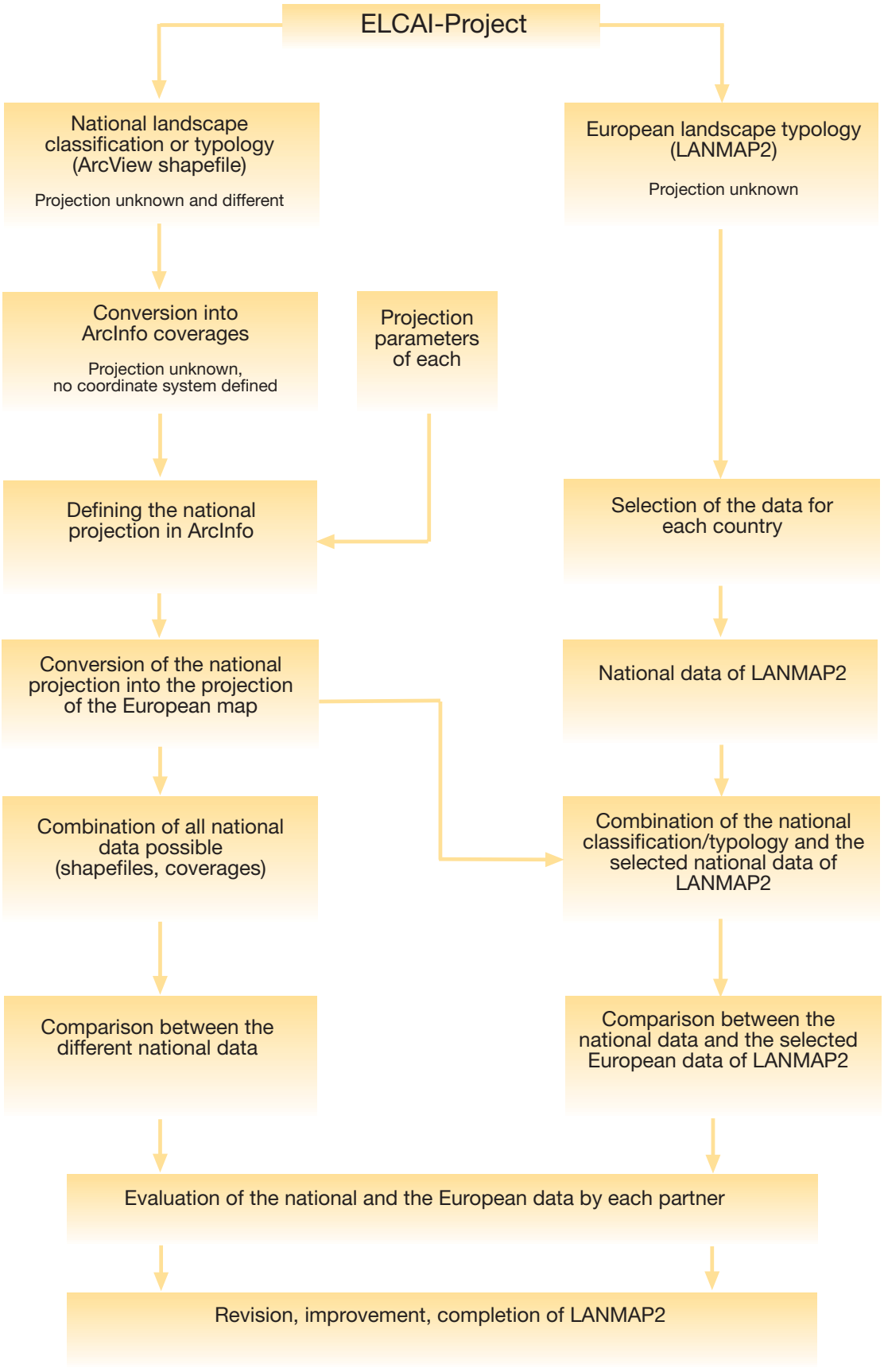


FIGURE 4.1. Stepwise approach for the development of a standardised digital database of the national and the European landscape typology.



However, most of the national data sets are available in form of ArcView shape files. There are restrictions concerning the use of the digital data for Austria and Germany. The authors of these two national classifications, the Federal Nature Conservation Agency in Germany and the University of Vienna, restrict the use of the data only for the ELCAI project. Between the University of Vienna and the UFZ Centre for Environmental Research Leipzig-Halle an agreement about the use of the data and the kind of citation was reached. The conditions of the agreements have been accepted as valid throughout the whole project. In principle, the work with data of other institutions requires special diligence, the protection of authority, the exact citation of the sources.

A first review of the national landscape data sets confirmed the assumption that all data sets are based on different map projections. So the national data sets could not be represented in one unique file and they could not be overlaid with the European data set. In general the shapefiles do not contain any information about the used projection. Therefore it was important to first receive the specific projection parameters of the national data sets by each partner. Then the shape files were converted into ArcInfo coverages. At this stage there is no co-ordinate system defined and the coverages do not contain any projection parameters. As a consequence, the projection of each dataset had to be defined in ArcInfo, depending from the input parameter of each country. Consequently, all national data sets now also have projection information. The following step comprised the transformation of all national classifications into one unique map projection. The map projection of the European landscape map LANMAP2 was used to convert the national projection into the European projection. After finishing these projection transformations it was possible to combine the national data sets in both GIS-systems ArcInfo (coverages) and ArcView (shape files). Furthermore it now was possible to overlay the national classifications with the European map.

In the following step, the national datasets were created from LANMAP2 representing the European landscape types for each participating country. This way a harmonised database has been developed containing both the national data and the selected European data. This database must be considered an essential precondition for the next analytical phase.

The national classification and the national part of the European map in the same projection were put at the disposal of each project partner in two forms as ArcView shape files and as ArcInfo coverages. So each country had all the relevant information for comparing between the national and the European map and for answering the questionnaire (see Section 4.5).

Figure 4.1 illustrates the methodological approach concerning the development of a standardised digital database of the national and the European landscape typology.

4.3 The comparison between national landscape typologies and LANMAP2

Chapter 3 presents the state-of-the-art of national, regional and local landscape classifications and typologies, their spatial properties, the used criteria and methods. In contrast, this chapter highlights the spatial dimension of the existing national landscape classifications or typologies. The objective is to visualise the national classifications in form of thematic maps. So the differences can be demonstrated concerning the used classification, the method, and the spatial resolution. Moreover the national classifications are compared with the European typology. So similarities and distinctions can be determined. This aspect was also one objective of the questionnaire that the project partners had to answer.

As mentioned earlier, only ten national classifications/ typologies were at our disposal. In some cases the project partner provided their landscape classification both in form of digital data (ArcView shape-file) and in form of a map (jpeg file). At first it was necessary to create thematic maps for those countries which did not provide the landscape information in a cartographic form. The maps were made using the developed harmonised national database.

In a next working step the national and the corresponding European data were analysed in terms of the number of types, the number of polygons, and the polygon sizes. Table 4.1 represents the results of this GIS-based analysis. Great differences relate to the size of the countries and the natural biophysical conditions. Furthermore, the great differences concerning the number of polygons between some national and the European data derive from sliver polygons along the national border due to differences of the national border coverages used in each country and at the European level.

The way national classifications are described can be divided into three groups:

1. Landscape types or landscape units/regions are described in a verbal form only. Examples are Germany, Austria, Hungary, the Netherlands, Spain, Portugal, and Norway.
2. Where landscape types are represented in form of a code, for example in Belgium and England. In both groups the landscape classes/types are represented in form of “natural” landscape units.
3. Landscape types are based on mobilité spatial regions, this is only the case in Switzerland. That means these “artificial” regions (similar to something like administrative units) are assigned to certain landscape types.

The national landscape classifications/typologies represent a great diversity concerning the used input parameter, the methods, the degree of generalisation, the spatial resolution, the kind and number of landscape types, the scale and the up-to-datedness. Therefore it is difficult to compare them.

In general it could be assumed that the transition from the national to the European level, the so-called bottom-up approach, would be accompanied by a generalisation and simplification of the contents, by a reduction of the spatial resolution and the degree of detail. The comparison between the national and the European landscape typologies shows that in five countries the assumption was confirmed. Compared with the national typology for Belgium, Austria, Hungary, Portugal, and England the number of landscape types has decreased, and the mean size of the area in the European classification has increased with the exception of Portugal. Here both the number of landscape types and the mean size of area have decreased. In the other five countries the assumption was not confirmed. For Switzerland, Germany, the Netherlands, Spain, and Norway the number of landscape types has increased while the mean size of area has decreased in the European landscape typology compared with the national typologies. In view of the lack of national landscape typologies for France, Denmark and Ireland, and the missing information about the Czech typology a comparison with the European typology is not possible. For the sake of completeness some information about the European landscape typology for these four countries has been included as well.

TABLE 4.1. Comparison between the national landscape classification and the European landscape typology.

		National Classification						European classification (LANMAP2)					
Code	Title	Title	Area [km²]	area [km²]	area [km²]	Nr. of polygons	Nr. of landscape types	Area [km²]	Min. area [km²]	Max. area [km²]	Mean area [km²]	Nr. of polygons	Nr. of landscape types
AT2 (Austria)	SINUS - cultural landscape types	83,948,7	0,002	1239,3	4,2	20128	42	83972,5	0,005	6893,7	308,7	272[1]	35
BE7 (Belgium)	Landscape characters of Belgium	31,475,5	0,999	1578,1	4,3	7320	48	30672,8	0,001	4154,5	176,3	174[1]	20
CH4 (Switzerland)	Landscape quality of mobilité spatiale regions	40,695,2	0,018	1470,6	276,8	147	6	41269,5	0,001	11432,0	122,8	336[1]	32
Czech Rep.	classification not available	–	–	–	–	–	–	78872,9	0,003	9150,1	288,9	273[1]	19
DE7 (Germany)	Landscape types of Germany	363394,0	0,006	3861,7	332,2	1094	24	357332,4	0,008	10066,0	212,6	1681[1]	67
Denmark	No classification tested	–	–	–	–	–	–	44721,8	0,002	5595,9	33,5	1334[2]	19
ES1 Spain	Spanish Landscape Atlas Associations of landscapes	498460,7	0,001	3499,8	265,3	1879	36	498360,8	0,012	10395,0	242,7	2053[2]	65
France	No national classification	–	–	–	–	–	–	548826,7	0,014	10142,2	244,7	22432	83
GB1 (England)	Countryside Character Initiative	130718,6	0,392	2493,1	71,4	1831	75	129959,7	0,004	7402,0	102,0	1274[2]	23
HU2 (Hungary)	Landscape types of Hungary	93011,4	0,025	2311,7	97,8	951	48	93091,2	0,005	8580,7	360,8	258[1]	25
Ireland	No national classification	–	–	–	–	–	–	70027,7	0,001	10871,5	53,4	1311[2]	30
NL2 (Netherlands)	Landscape types of the Netherlands	37720,0	0,157	4645,4	336,8	112	9	35220,3	0,001	3416,7	53,5	658[2]	19
NO1 (Norway*)	The Norwegian landscape reference system	321342,7	0,020	13554,8	292,1	1100	45	326494,8	0,014	16430,2	39,5	8264[2]	67
PT1 (Portugal)	Landscape characterisation in Portugal (units and groups)	88894,9	0,004	3413,4	386,5	230	128	88859,3	0,037	8662,8	186,7	476[2]	34

[1] few sliver polygons. [2] many sliver polygons. * without Spitzbergen and Jan Mayen island.

AT2: SINUS – cultural landscape types (Austria)

In Austria a classification of cultural landscapes was made based on a visual interpretation of satellite images (LANDSAT TM5) and delineation of cultural landscape type series and groups in the scale of 1:200,000 (Wrbka, T. *et al*. 1998, 1999; 2000, Szerencsits, E. *et al.*1999, http://www.pph.univie.ac.at/intwo). The delineation is based on the land use mosaic, structural features of the landscape and landforms (see Map 4.2) and was done manually not automatically as in LANMAP2. Similar criteria as in LANMAP2 have been used for the delineation but in different hierarchical order. Box 4.1 gives an overview over the 42 landscape types assigned to 12 landscape type groups. The national landscape typology is very detailed concerning the spatial resolution because it is derived from satellite images (pixel-based representation). The result is about 20,000 polygons representing the Austrian landscape types (see Figure 4.2.1). The spatial resolution of the European typology is much coarser representing 35 landscape types in about 270 polygons only (see Figures

4.2.2 and 4.2.3). This is also visible in the distinction of the mean size of area. In the national typology the mean area has a size of about 4 km² and in the European map about 308 km². Table II.1 (see Annex II) gives an overview over the landscape types of the European landscape typology for Austria. Austrian landscape types are influenced by continental, Mediterranean or alpine climate. With regards to the topography hills, mountains, high mountains and alpine regions shape the landscape.

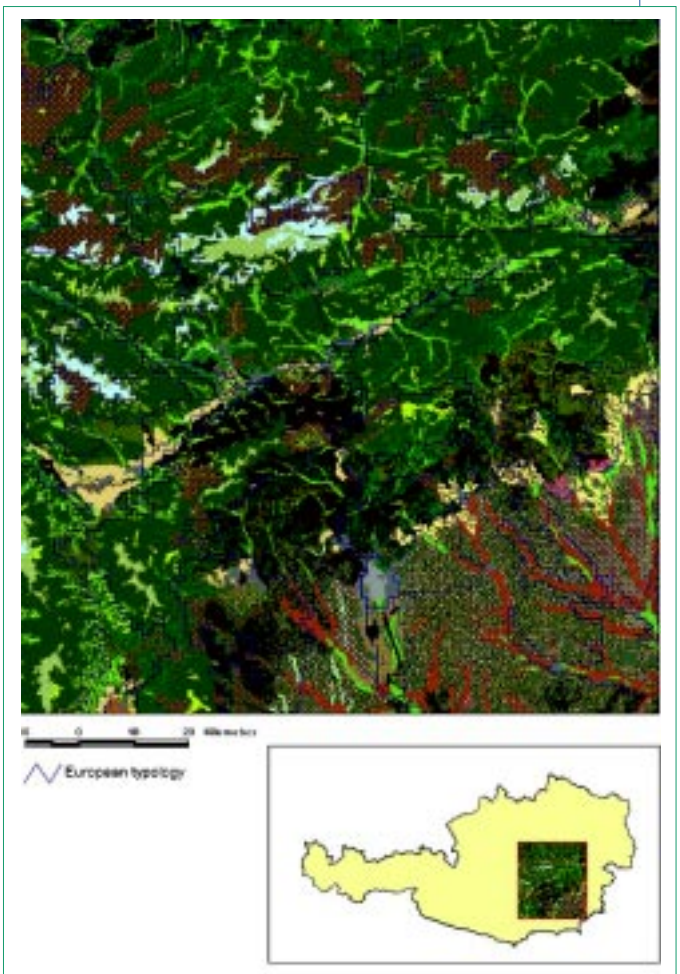
The four dominant landscape types are:

- Zmr_fo (**a**lpine **m**ountains dominated by **r**ocks and **f**orests) with an area of 16001,4 km² (24 polygons) covering 19.0% of the country's area;
- Cmr_fo (**C**ontinental **m**ountains dominated by rocks and forests) with 12920,6 km² (21 polygons) covering 15.4%;
- Chs_al (**C**ontinental **h**ills dominated by **s**ediments and **a**rable **l**and) with 10747,9 km² (62 polygons) and a share of 12.8%; and
- Znr_fo (**A**lpine high mountains dominated by rocks and forests) with 8934,7 km² and a share of 10.6% in the country's area.

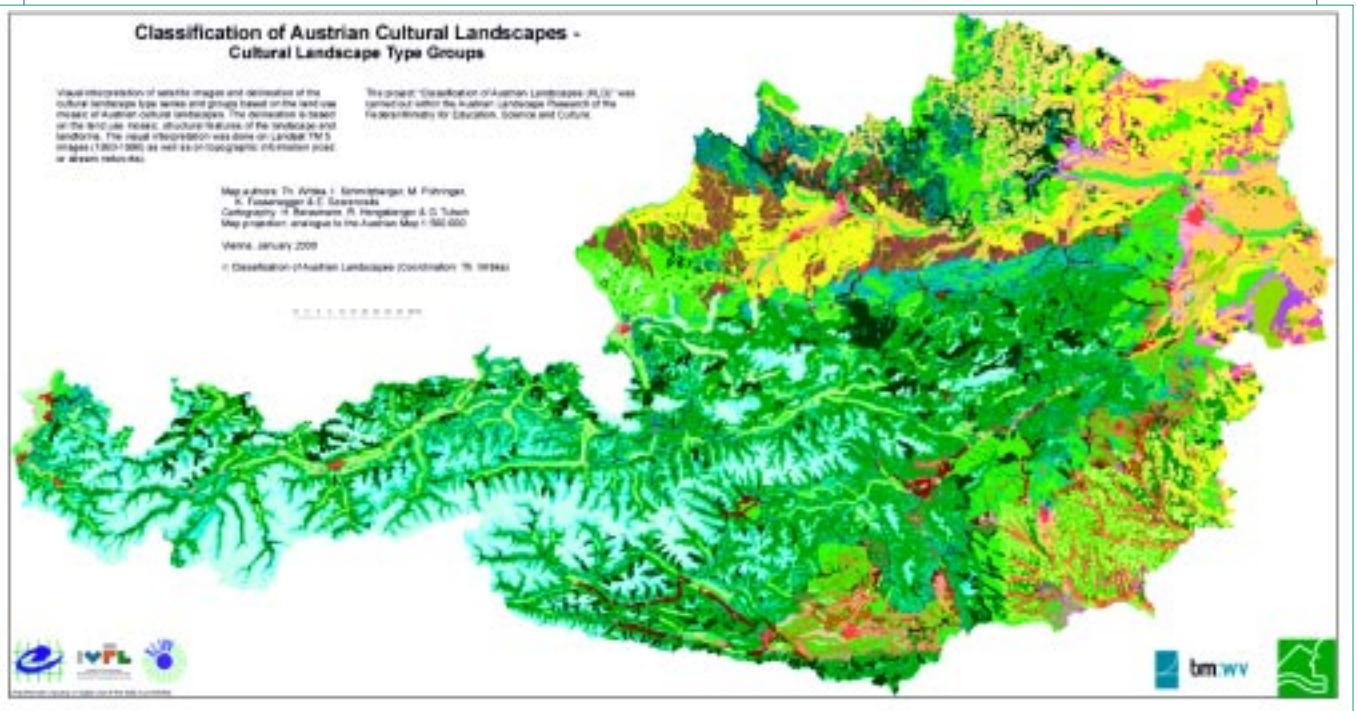
Each of all the other 31 landscape types covers less than 4% of the Austrian territory.

There is a problem with regions having extreme differences in altitude per area, e.g. the Alps. Especially in mountainous areas the spatial resolution is not satisfying as valley floors, slopes and summits are distinguished only in a few large valleys in the European typology. The rest including medium sized valleys which are important for the character of "mountain farming" landscapes are not distinguished. The spatial resolution

FIGURE 4.2. Comparison between the landscape typology of Austria and the European landscape typology. Enlargement of a section as indicated on the inset map.



MAP 4.2. Map of the classification of Austrian cultural landscapes.



of topography is insufficient for the delineation of medium-scale valleys and other terrain variations that are so important for alpine cultural landscapes and ecology. Therefore a reclassification of mountainous areas with different thresholds for the altitudinal range would be solving this problem. Another problem is the climate. The category “continental” in the European map does not depict the real situation in the Austrian lowlands. For instance there is a gradient in annual precipitation ranging from >400 mm to <1,500 mm which is summarised as “continental” in LANMAP2. From an ecological point of view, such a big difference within one category poses some problems. Mediterranean climate is overrepresented. There is no true Mediterranean climate in Austria. The respective climate types are considered as “sub-Mediterranean” as there is frost in winter. In terms of parent material there are obviously some errors concerning “rock” (overestimated in the lowlands), “sandy” category (underestimated in alpine valleys and basins) and “organic” category (should include peatland in some rather humid lowland and alpine regions). In addition, the two categories “rocks” and “sandy” do not show enough the ecological differentiation (e.g. sandy vs. clayey or basic vs. acidic). Land cover based on high level CORINE data is much too coarse and some of the categories are rather misleading. Due to the poor spatial resolution permanent grassland in alpine landscapes (slopes, minor valleys) is underestimated or even missing in large parts. Therefore the aggregated categories of CORINE land cover data have to be redefined.

BOX 4.1. Cultural Landscape Type Series and Groups of Austria.

A Alpine rocks and areas of ice
- 101 Rocks and glaciers of alpine highlands

B Alpine and subalpine grassland landscapes
- 102 Seminatural and natural grassland of alpine highlands
- 103 Sub-alpine intensive pasture land

C Elongated forest landscapes
- 201 Forested mountain slopes
- 203 Bands of ripiarian woodland along big rivers
- 204 Forested gorges and narrow valleys

D Areal forest landscapes
- 202 Large extra-alpine forest patches
- 205 Forest dominated secondary mountain ranges

E Upland dairyfarming landscapes with high proportion of permanent grassland
- 301 Grassland dominated inner-alpine clearings
- 302 Grassland dominated, narrow, alpine valleys
- 303 Grassland dominated clearings on the alpine fringe
- 308 Grassland dominated landscapes of extra-alpine uplands

F Dairyfarming landscapes of glacial valleys and basins with high proportion of permanent grassland
- 304 Grassland dominated alpine lake basins and glacial morrain landscapes
- 305 Grassland dominated inner-alpine basines and valley floors
- 310 Grassland dominated extra-alpine downland

G Lowland mixed farming landscapes with high proportion of permanent grassland
- 306 Grassland dominated extra-alpine lake- and tectonic basins
- 307 Grassland dominated extra-alpine valleys and basins
- 309 Extended fallowlands
- 311 Extended extra-alpine xeric grassland and pasture landscapes
- 312 Illyric grassland – fruit – foddercrop complexes
- 313 Grassland dominated extra-alpine narrow valleys

H Cultural landscapes with mixed arable-grassland agriculture and foddercrop production
- 401 Inner-alpine basines and valley floors with mixed arable-grassland farming
- 402 Extra-alpine downlands with mixed arable-grassland farming and foddercrops
- 406 Pre-alpine clearings with mixed arable-grassland farming and foddercrops
- 407 Clearings on the alpine fringe with mixed arable-grassland farmings
- 409 Lake basins with foddercrops
- 410 Inner-alpine basines and valley floors with foddercrops
- 411 Extra-alpine basines and valley floor with foddercrops

I Arable landscapes of extra-alpine down- and lowlands
- 403 Extra-alpine downlands with dominant grain farming
- 404 Extra-alpine basins and valley floors with dominant grain farming
- 405 Extra-alpine clearings with arable farming
- 408 Extra-alpine mountains with arable farming

J Viniculture landscapes
- 601 Flatlands and soft slopes with dominant viniculture
- 602 Steeper slopes with dominant viniculture

K Viniculture landscapes with high proportion of arable land
- 603 Pannonian arable – viniculture complexes
- 604 Illyric fruit- viniculture – foddercrop complexes

L Settlement- urban and industrial landscapes
- 701 Urban areas
- 702 Densely buildt up areas along traffic arteries
- 703 Historically grown industrial and settlement landscape
- 704 Young industrial and settlement landscape
- 705 Small towns and suburban settlements
- 706 Large excavation and landfill sites

BE7: Landscape characters of Belgium

In Belgium during the last few years a new landscape typology was developed with the objective to define Landscape Character Areas for the whole country based on a unique methodology (Van Eetvelde and Antrop 2004). On the one hand, this new typology should complete the two existing different region-specific typologies: the traditional landscapes in the Flanders region (Antrop 2001) and the "Territoires paysager" in the Walloon region (Droeven *et al.* 2003). On the other hand, there was a lack of data for the Brussels Capital region which is not represented as such.

The country's area was divided into grid cells of 1 km x 1 km. Each grid cell was characterised by 18 thematic variables. Then 48 landscape types have been determined to describe the landscapes represented in 7,320 polygons (see Map 4.3). CORINE land cover data from 1995, soil associations, the digital elevation model, and satellite images of Landsat TM available for the whole country were used as sources for the classification of Landscape Character Areas (see also http://geoweb.UGent.be/services/index.asp). By means of a four parts code each Landscape Character Area is described. The code has the following structure: **X.Y. r/r'.h.** The following four parameters form the code: land cover (first letter), soil association (second letter), main attribute/relief variation (third figure, fourth figure) and heterogeneity (see Box 4.2 for details).

In the European landscape typology only 20 landscape types are determined for Belgium represented in 174 polygons (see Figures 4.3.1 and 4.3.2). Table II.3 (see Annex II) gives an overview over the 20 European landscape types determined for Belgium. A comparison between the national and the European landscape typology shows that the national typology is much more detailed than the European one. The mean size of area in the national typology is with 4.3 km² much smaller than in the European one with 176.3 km² due to the national fine spatial resolution mentioned above.

The following four landscape types dominate the Belgian landscape:

- Als_al (Atlantic lowland dominated by sediments and arable land) with 8,186.8 km² (27 polygons) covering 26.7% of the territory;
- Chs_fo (Continental hills dominated by sediments and forests) with 6,004.4 km² and a share of 19.6%;
- urban areas with 4,499.0 km² (33 polygons) and a share of 14.7%; and

Map 4.3. Map of the landscape characters of Belgium.

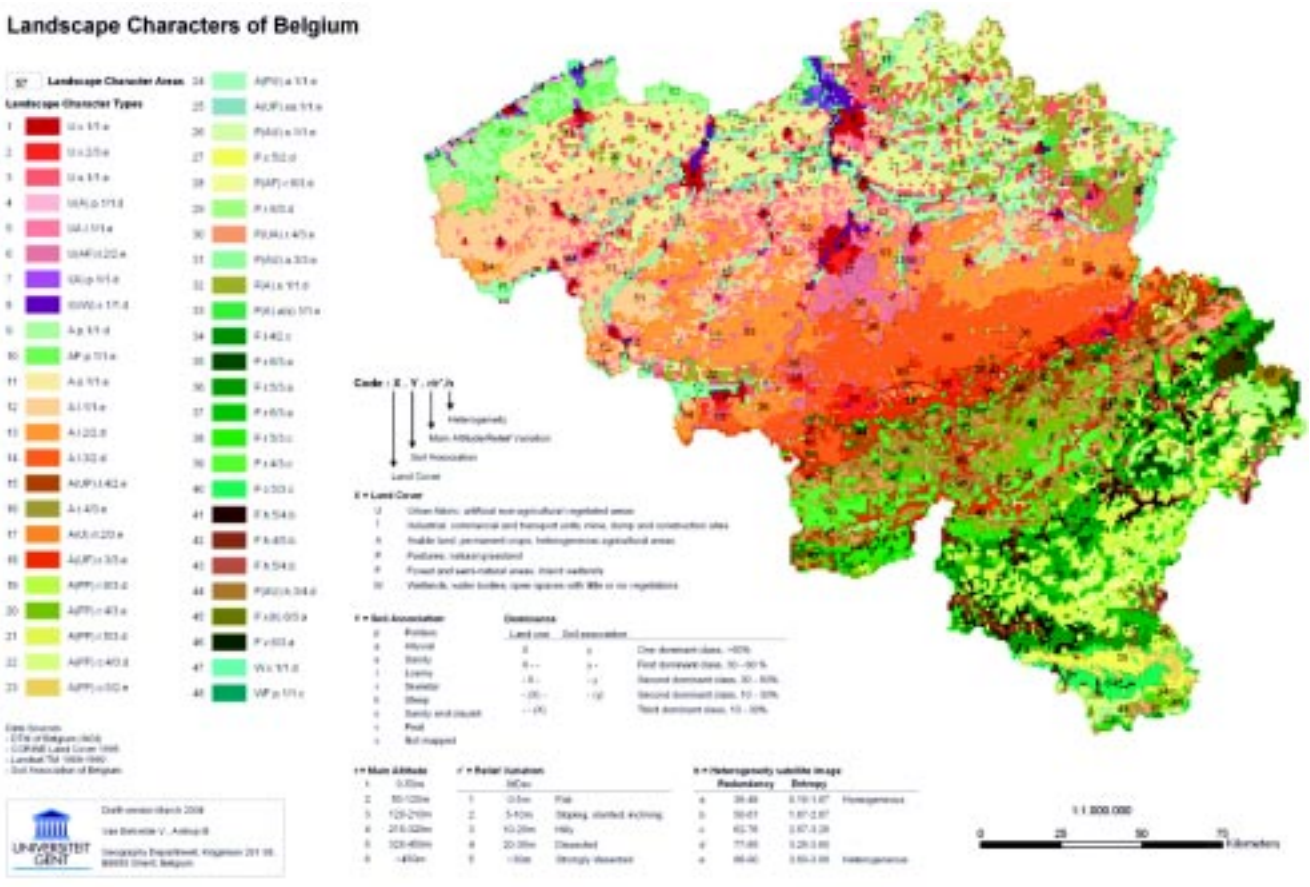
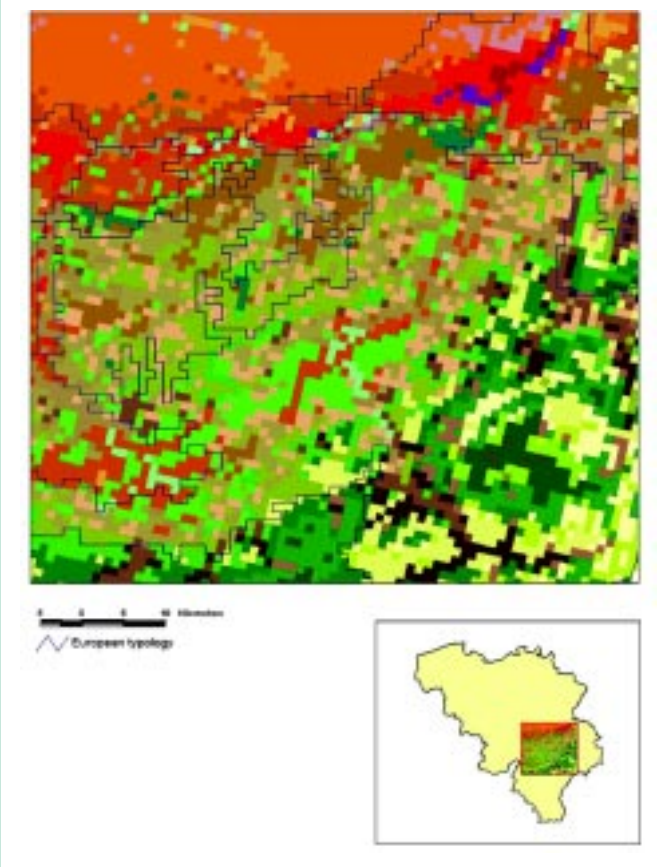


FIGURE 4.3. Comparison between the Landscape Character Types of Belgium and the European landscape typology. Enlargement of a section as indicated on the inset map.



- Als_ha (Atlantic lowland dominated by sediments and heterogeneous agricultural areas) with 3,187.1 km² (25 polygons) representing 10.4% of the country.

Each of the other 16 landscape types has a share less than 9% in the area of the country.

The European landscape typology reflects the national situation partly. Some of the delineated landscape units have no differentiation in characteristics, although landscape types are different. For example the polder area of the Belgium coastline is different from the sand and loamy regions land inwards. The valleys of the river Scheldt, Leie, Demer and Gete are also indicated but they have the same attributes as the surrounding regions. Furthermore some landscape units refer to artificial surfaces, which is wrong. For example the region in the northern part of Flanders (Kempen) is very heterogeneous with agricultural land, wood, scattered housing, industry and uncovered areas with sand and water. Also the two smaller areas in the western part of Brussels are indicated as artificial surfaces while this is the valley of the river Dender. Two smaller areas in the Walloon region belong to the river valleys of Meuse and Samber. The artificial area south of the city of Liege contains the smaller valley of the river Hoëgne and surrounding areas.

The landscape types indicating the forest areas in the southern part of Belgium are too extended. Furthermore the urban regions are too much expanded, in particular for the larger cities in Flanders because the entire suburban zones are included in the urban core areas. It gives the wrong impression as if the northern part of the country is almost completely urban area. Concerning the altitude the class between 500 m and 700 m representing the highest regions in Belgium is indicated as “mountains” but it is a plateau. In general a redefinition of input data classes could contribute to an improved European landscape typology.

BOX 4.2. Landscape Character Code in Belgium.

X = land cover

- **U** Urban fabric; artificial non-agricultural vegetated areas
- **I** Industrial, commercial and transport units; mine, dump and construction sites
- **A** Arable land; permanent crops; heterogeneous agricultural areas
- **P** Pasture; natural grassland
- **F** Forests and semi-natural areas; inland wetlands
- **W** Wetlands; water bodies; open spaces with little or no vegetations

Y = Soil association

- **p** Polders
- **a** Alluvial
- **s** Sandy
- **l** Loamy
- **r** Skeletal
- **h** Steep
- **c** Sandy and clayish
- **v** Peat
- **x** Not mapped

r = Main altitude

- **1** 0 m – 50 m
- **2** 50 m – 120 m
- **3** 120 m – 210 m
- **4** 210 m – 320 m
- **5** 320 m – 450 m
- **6** > 450 m

r’ = Relief Variation

1	0 m – 5 m	Flat
2	5 m – 10 m	Sloping; siented, indenting
3	10 m – 20 m	Hilly
4	20 m – 30 m	Dissected
5	> 30 m	Strongly dissected

h = Heterogeneity satellite image

	Redundancy	Entropy	
a	36–49	0.16–1.87	Homogeneous
b	50–61	1.87–2.67	
c	62–76	2.67–3.26	
d	77–85	3.26–3.60	
e	86–90	3.60–3.98	Heterogeneous

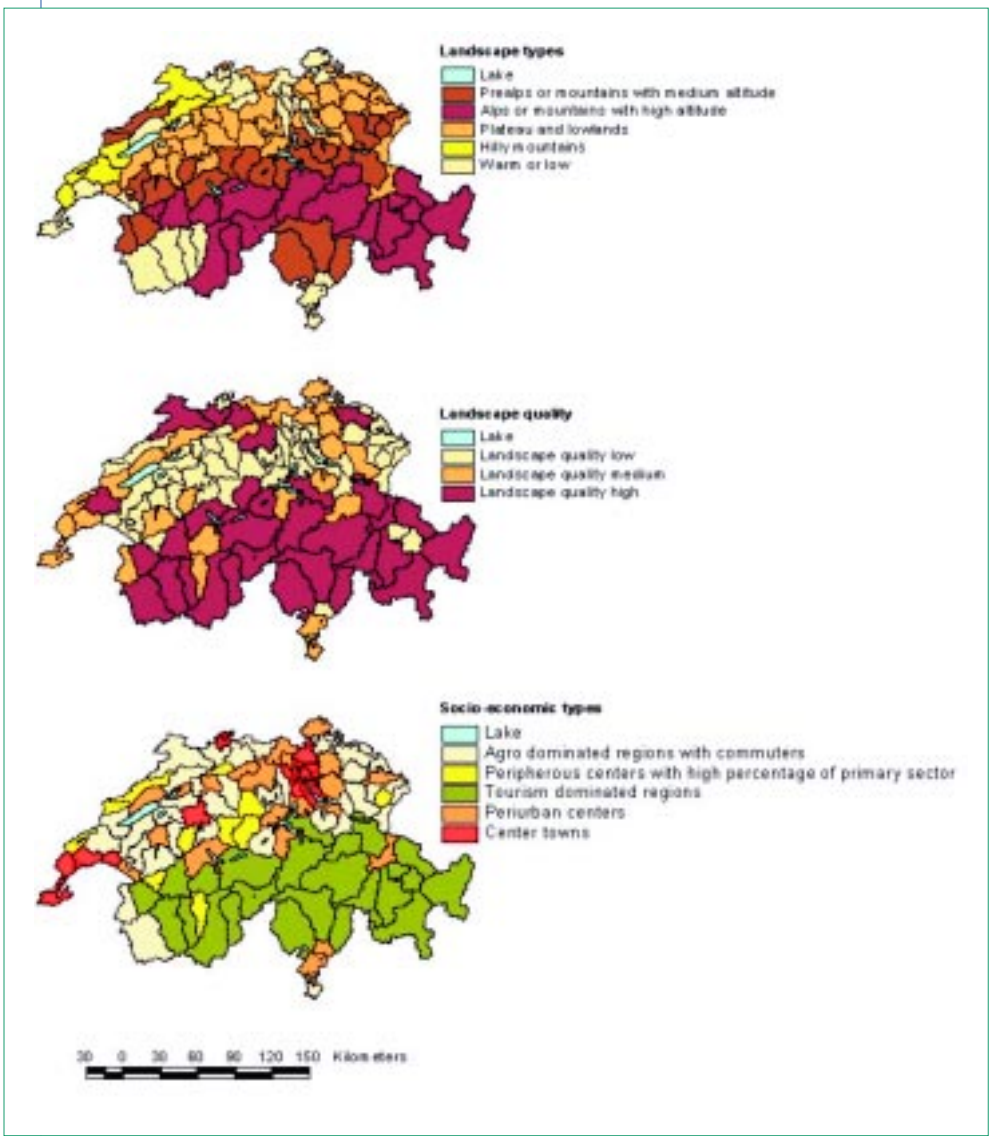
CH4: Landscape quality of mobilité spatiale regions (Switzerland)

In comparison with the above mentioned national landscape typologies, Switzerland must be considered to form an exception as it belongs to the third group of national landscape typologies. This country uses another method to describe the landscapes on a national level. So-called mobile spatial regions representing planning relevant regions form the spatial basis for the determination of landscape types, for the evaluation of landscape quality or for their classification in socio-economic types (see Map 4.4 and http://www.wsl.ch/land/products/biosphaere/popup/LS-typ.htm). For each mobilité spatial region 24 landscape parameters were calculated on the base of national datasets. Each of the 147 mobile spatial regions is assigned to one of the following six landscape types:

- lake;
- pre-alps or mountains with medium altitude;
- alps or mountains with high altitude;
- platean and lowlands;
- hilly mountains; and
- warm or low (sites).

To define the landscape quality and to determine the socioeconomic types of the mobilité spatial regions in addition to landscape parameters information of flora and fauna, landscape heritage aspects, and socioeconomic parameters were used (http://www.wsl.ch/land/products/biosphaere/popup/datengr.htm).

In the European landscape typology 32 landscape types represent the landscapes of Switzerland in 336 polygons. The different used methods are visible in the comparison between the national and the European landscape typology (see Figure 4.4). Because of the specific of the Swiss landscape typology it is difficult to compare both maps. The mean size of area is in the national typology with 276.8 km² much higher than in the European one with 122.8 km². The landscape types of the European map for Switzerland are listed in Table II.3 (see Annex II).



MAP 4.4. Map of the landscape quality of Mobilité Spatiale Regions in Switzerland.

The landscape types:

- **Z**nr_op (Alpine high mountains dominated by **r**ocks and **op**en spaces with little or no vegetation) with 17641.6 km² (10 polygons) representing 42.8% of the country's area; and
- Cms_ha (**C**ontinental **m**ountains dominated by **s**ediments and **h**eterogeneous agricultural areas) with 11444.6 km² (23 polygons) and a share of 27.7% of the territory are the two dominant landscape types of Switzerland.

Each of all the other 30 landscape types cover less than 5% of the country.

In general the European landscape typology reflects the national situation. But large parts of the Swiss lowlands with an altitude between 300 m and 500 m belong to the mountains in the European map. There is a good match with the alpine mountains and the hills of the Jura mountains. Probably the altitude alone might not be an appropriate surrogate for topography. In addition, the roughness of the terrain should be taken into consideration for improving the classification and typology.

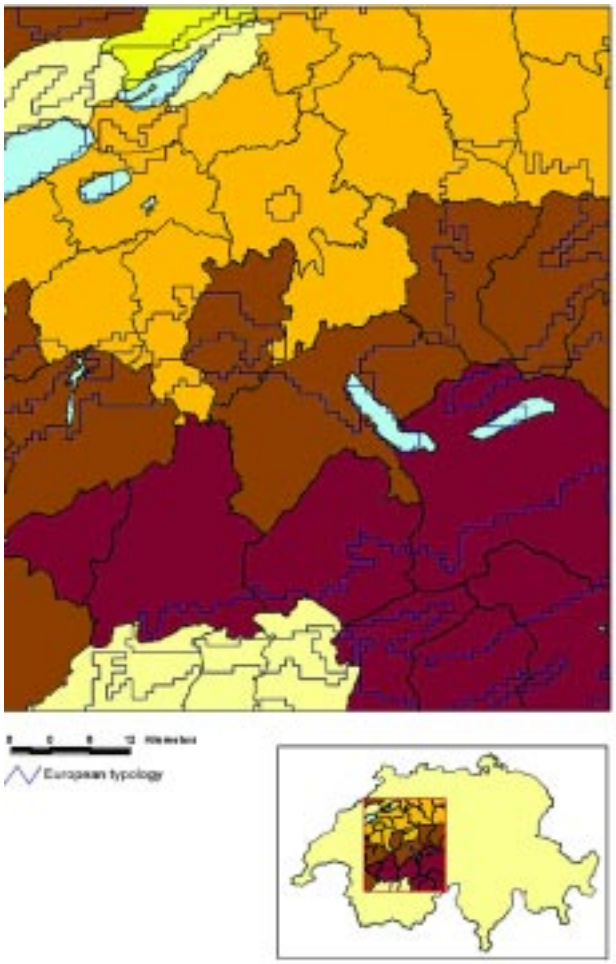


FIGURE 4.4. Comparison between the landscape types of Switzerland and the European landscape typology.
Enlargement of a section as indicated on the inset map.

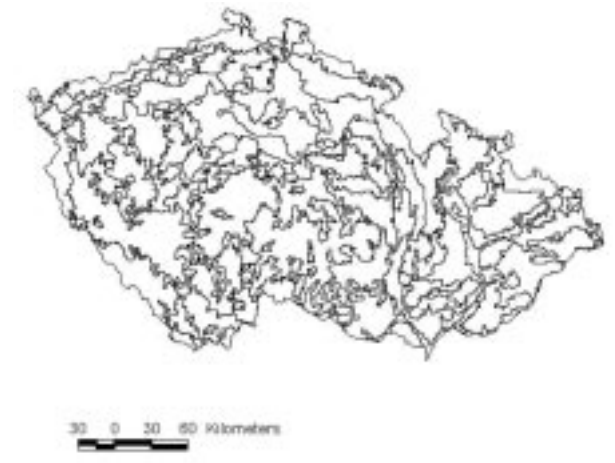
Czech Republic

For the Czech Republic a national landscape typology exists but the data were not available both in an analogue and a digital form within the ELCAI project. It is known that during the 70ties and 80ties a landscape typology was elaborated by TERPLAN for the whole country (Lipsky, 2003). Altogether nine landscape types characterise the Czech landscapes. There are three basic landscape types: fully anthropogenic landscapes, harmonic cultural landscapes, and relatively natural landscapes. Each of these types was subdivided into the following subtypes: landscapes of increased, basic (average) and decreased landscape value.

According to the European landscape typology for the Czech Republic 19 landscape types with 273 polygons were identified (see Map 4.5). The mean size of area is 288.9 km² (see Table 4.1). In Table II.11 (see Annex II) the European landscape types for the Czech Republic are listed.

Two landscape types are the dominant ones: Chs_al (**C**ontinental **h**ills dominated by **s**ediments and **a**rable **l**and) with an area of 22164.1 km² (67 polygons) covering 28.1% of the country, and Chr_al (**C**ontinental **h**ills dominated by **r**ocks and **a**rable **l**and) with 21936.0 km² and a share of 27.8 km². Each of the other 17 landscape types has a share less than 12%.

MAP 4.5. Landscape types of the European landscape typology map (LANMAP2) for the Czech Republic.



DE7: Landscape types of Germany

In Germany the Federal Nature Conservation Agency (Gharadjedaghi *et al.* 2004) developed a new map of landscape types in the scale of 1:1 million. This represented 24 landscape types assigned to six main types with a total of about 1,000 polygons (see Map 4.6). The landscape types are described in a verbal form. The used input parameters are topographic maps in the scale of 1:200000, CORINE Land Cover data and the classification of natural landscape in Germany (Meynen and Schmitthüsen 1962). The landscapes were delineated by means of GIS based on the natural landscapes of Meynen and Schmitthüsen and overlaid with the soil cover and CORINE land cover data. Furthermore, landscape and regional plans, and landscape programs were analyzed and additional criteria information about the cultural and historic development and landscape structures were used.

A comparison with the LANMAP2 (see Figures 4.5.1 and 4.5.2) shows the similarities and distinctions between both typologies. The national landscape typology consists of about 1,000 polygons representing 24 landscape types. In LANMAP2 67 landscape types with about 1,600 polygons show the diversity of German landscapes (see Table 4.1 and Table II.5 in Annex II). Table II.5 gives an overview for the European landscape types for Germany concerning the frequency (number of polygons) of each type, the different types and the area covered by each type. By means of this information it will be possible to analyze which climate, topography, parent material and land cover class form the landscape types. For example, the map shows that German landscapes underlie the Atlantic, continental or alpine climate. In terms of the topography four of the five classes occur. These are lowland, hills, mountains and high mountains. The class alpine with an altitude greater than 2,500 m does not appear. The landscape types are classified concerning the parent material in rocks, sediments or organic material. There is no polygon and landscape type where the parent material is not classified. All ten land cover classes occur in the landscape types. Furthermore by means of Table II.5 it can be analysed which landscape types occur most frequently and which are occasional. In Germany three landscape types have a share of about 10% in the country's area.

MAP 4.6. Map of landscapes types of Germany.

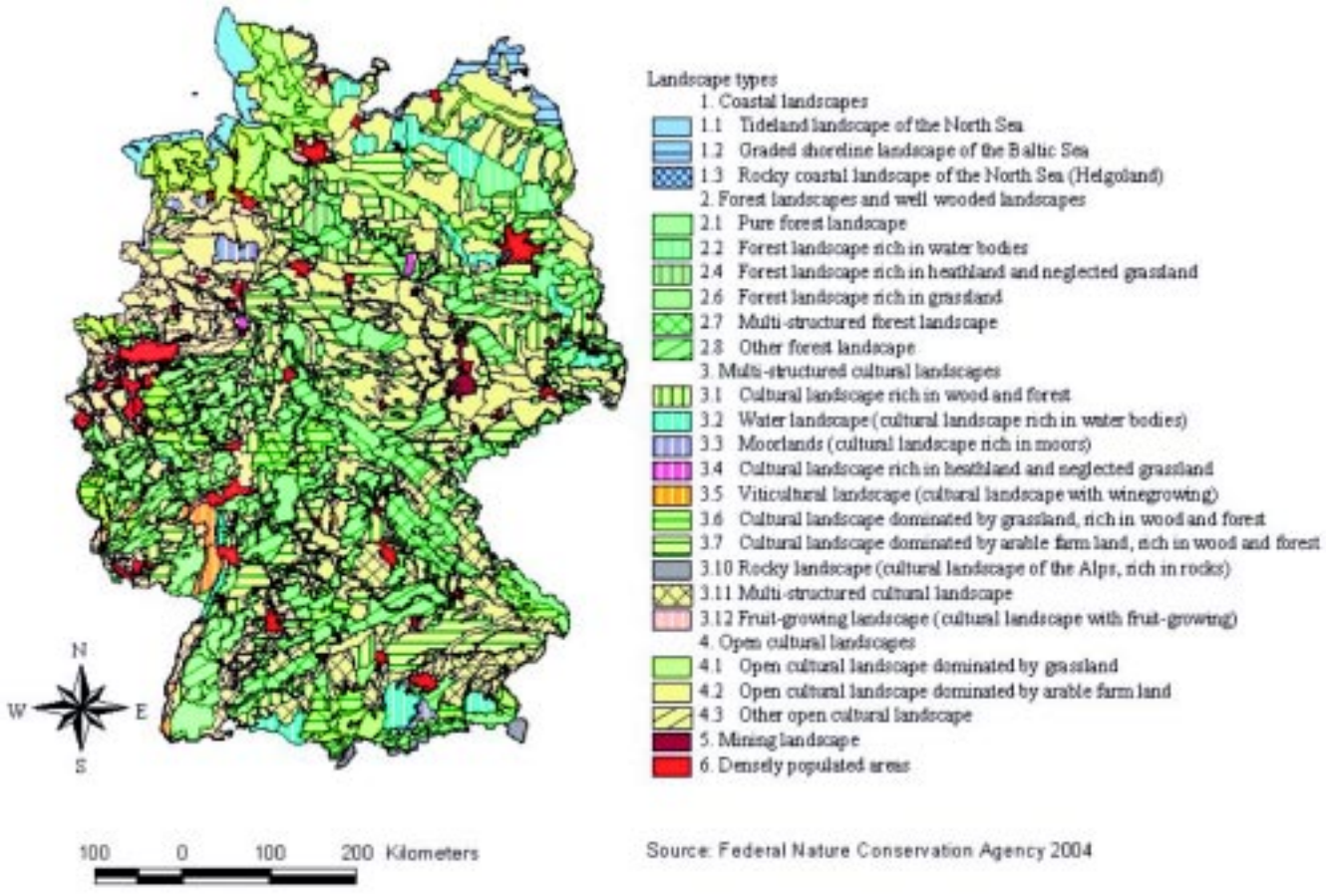
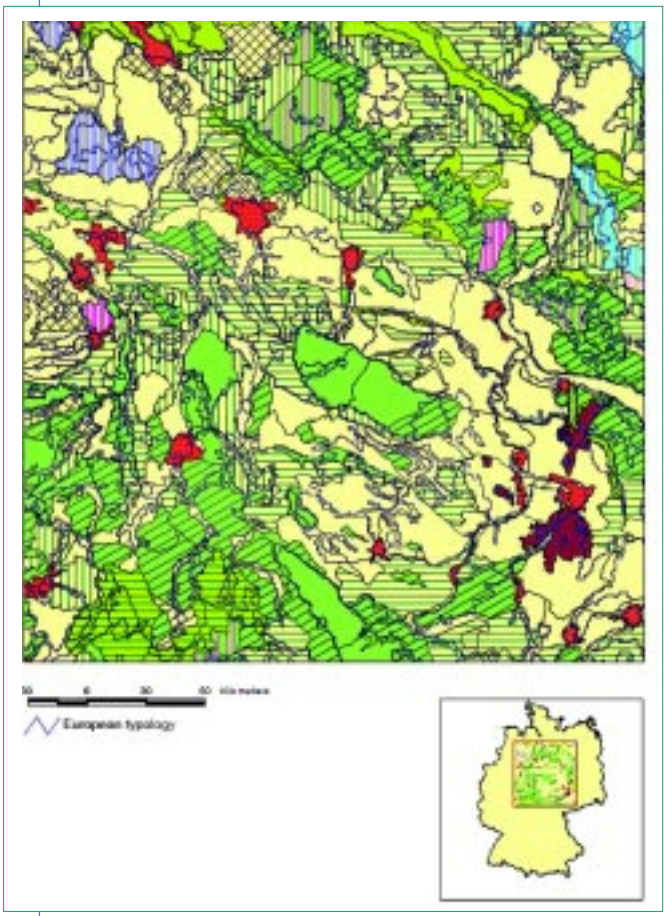


FIGURE 4.5. Comparison between the landscape typology of Germany and the European landscape typology. Enlargement of a section as indicated on the inset map.



These are the following landscape types:

- Cls_al (**C**ontinental lowland dominated by **s**ediments and **a**rable **l**and) with 59548.9 km² represented in 112 polygons which has with 16.7% the highest share in the country's area followed by the type;
- Chs_al (**C**ontinental **h**ills dominated by **s**ediments and **a**rable **l**and) with an area of 45073.6 km² (70 polygons) covering 12.6%; and
- Als_al (**A**tlantic **l**owland dominated by **s**ediments and **a**rable **l**and) with an area of 39154.3 km² (50 polygons) covering 11% of the country's area.

Regarding all the other 64 landscape types each one covers less than 10% of the country. Forty-six landscape types have a share of less than 1% in the country's area.

The mean area in the national typology is 332 km² greater and coarser than the European one of 212 km². The identified European landscape types reflect the national situation well and is more detailed than the national one. There are differences concerning the delineation of landscapes, but the basic pattern is comparable. The unit boundaries are more precise in the national landscape typology. The CORINE land cover classification of agricultural areas is arbitrary, e.g. pastures and meadows constitute one class. This does not represent the ecology of the areas and their land use potential. Furthermore heterogeneous agricultural landscapes are not adequately represented. The integration of more expert knowledge could lead to an improvement of the delineation between floodplain areas, loess regions and low mountains.

BOX 4.3. Landscape Character of Uckermark. A case study from Brandenburg, north-east Germany.

The Uckermark Region is situated in the north-east of the Federal State of Brandenburg, bordering to the east the Republic of Poland. Uckermark is a typical example of a remote rural area that lacks infrastructure which is in a transitional stage.

The administrative unit "Landkreis Uckermark" has an area of 3,058 km², the largest of all "Landkreise" in Germany. Ever since the process of unification in Germany began in 1990, the area has lost 16% of its population. This will probably continue. It is forecasted that by 2020 the population will have shrunk by another 16%, leaving only about 120,000 inhabitants. Uckermark's population in 2004 was 141,454 which made it one of the lowest population density areas in Germany. Its current population density of 47 per km² will be about 40 per km² by 2020. Emigrants are mostly between 18 and 30 years and have an above-average school education.

Agricultural land use is most abundant here (58% of the total area, the highest proportion in the whole State of Brandenburg) as the soils are fertile, with wheat yield of 6–7 t/ha. The farm structure allows for very effective agriculture with the average farm size of 300 ha (see Figures 4.3.1 and 4.3.2; average farm size in Germany: 40 ha; in the State of Brandenburg: 200 ha). Out of the 590 farms, 20% are bigger than 500 ha. As a consequence, many homesteads have been deserted (see Figure 4.3.3). Organic farming plays an important role: 9.2% of farm land here is managed by 55 organic farming enterprises.

Figure 4.3.1.

Figure 4.3.2.

The spatial structures of the Uckermark landscapes are essentially a product of the continental glaciers and the melt waters from the last ice age. The continental glacier had left its mark in the form of an out-washed plain, low hills or cupola-shaped ground moraine surfaces and end moraines, sand-siliceous melt water deposits (the sanders), as well as wide glacial basins. This history of landscape genesis has strongly influenced the hydrological and groundwater conditions of Uckermark.

End-moraine arches rise up as hilly chains of about 80–120 m above NN. To the north or north-east is moraine, tapering off in hills or undulations. In the melt-water runoff channels, sands have accumulated over large areas as sand-gravel sediments. Glacial valleys of different widths and lowlands complete the basic elements of the glacial series. Glacial, glacio-fluvial, peri- and post-glacial processes have created an extraordinarily rich variety of landscape forms in the course of landscape development.

The area is divided into numerous hierarchically structured inner catchment areas without connection to the sea. Prominent features in the hydrological system, besides the river basin of the river Oder, are large lakes and numerous very small lakes, so-called “Sölle” (potholes, see Figure 4.3.4). Apart from the river Oder there are only insignificant running waters in the study area. Although groundwater is present in the entire area, the aquifers are usually at depths inaccessible to plant roots.

Due to the geological basic substance and the landscape genesis or the land use history respectively, very differentiated structures of soil and site conditions can be found. In the areas formed by basic moraines, where agriculture is suitable, a soil formation with boulder clay (“Geschiebemergel”) took place. In the hilly areas, eroded haplic luvisols (“Para-Braunerde”) or haplic rendzines (“Para-Rendzina”) prevail while on the middle and lower slopes, haplic brownearth soils (“Para-Braunerde”) with the transition to stagnosol (“Pseudogley”). End-morains and outwash plains are typical sites of forests today. The small-scale heterogeneity and the partially high percentage of stones have to be considered as special characteristics.

Climatically, the region can be characterised as a transition area between the north-western lowlands, which are rather influenced by a maritime climate, and the south-eastern areas which are more influenced by a continental climate, with the annual mean precipitation value of 500 to 640 mm/a.

Flora and fauna

Due to the variety of the relief, the hydrology and the soil cover in combination with various climatic influences, the area has become a crossroads of actual and potential vegetation. Western (sub-oceanic) beech forests in large, dome-like stands are the predominant landscape features in the area of the ground moraines, e.g. around the villages Chorin and Grumsin. The diversity of the biotic structure is an important indicator of valuable cultural landscapes. In terms of flora and fauna, the region is habitat to rare species which are threatened by extinction in other places.

The presence of these plants and animals is evidence of conservation management of the environment in the recent past and present. Additionally, Uckermark is rich in very attractive areas (see Figures 4.3.5 and 4.3.6).

There are three rather large areas in Uckermark that have been reserved for nature conservation. They are:
Lower Oder River Valley National Park (Nationalpark Unteres Odertal): This national park extends out on both sides of the river Oder into Poland and Germany, to a total size of 1,172 km², with the German part being 105 km².

Biosphere Reserve (Biosphärenreservat) Schorfheide-Chorin: Size: 1,291 km², is mostly a zone for the development of the cultural landscape (1,000 km²), the rest of the area is designated for nature protection.

Nature Park (Naturpark) Uckermärkische Seen: Total size 896 km², with 60% of the area as protected landscape (Landschaftsschutzgebiet) or nature reserve (Naturschutzgebiet).

Figure 4.3.3.

Figure 4.3.4.

Figure 4.3.5.

Figure 4.3.6.

In addition to these larger areas, 52 more nature reserves and eight protected landscape areas constitute about 63% of the Uckermark area protected areas, which is a very high proportion.

The Uckermark, with little industry, is economically underdeveloped and had an unemployment rate of 27% in 2004. Although economic development is important it causes conflict with nature conservation. Some important examples are:

- The extension of a waterway, which will affect part of the National Park.
- The construction of a new border crossing near the industrial centre of Schwedt, which would imply the building of a new road within the National Park that crosses the river Oder.
- New livestock facilities, especially for pig fattening, which can cause an increase in traffic, due to the transport of animals, fodder and liquid manure within an attractive and protected landscape. In addition, the manure will lead to nutrient enrichment in sensitive ecosystems and a permanent olfactory nuisance.

Because some larger lakes (Unteruckersee: 10.7 km², Oberuckersee: 5.9 km²) are part of the protected areas, the access to and the recreational use of these lakes (e.g. water sports) is restricted.

The conflicts between the two different interest groups of economic development and nature protection are often characterised by an unwillingness to co-operate. There is also discontent with the State government for the inadequate transparency of planning processes, their bias toward nature protection, and the insufficient participation of the local population.

It is important to note that these large areas of nature and landscape protection are an important source of tourism in this area.

The establishment of large protected areas is bound to the claim of development, perfection, and realisation of integrated approaches for the reconciliation of ecological and economic demands in model quality. Nature- and sustainability-oriented management forms which offer employment and income possibilities to the local population have to be set up and organised. With this in mind, the administration, the associations of farmers and other groups are trying to design new systems of ecological land use, which consider all interests, including the interests of agriculture as a model for this and other regions.

Landscape Character Assessment of Uckermark

A topographic map of the north-east of Brandenburg, including Uckermark is given in Figure 4.3.7. In this map, some characteristics of Uckermark are obvious: Abundant water bodies and river valleys. The LANMAP shows four land use types within Uckermark (Figure 4.3.8): Artificial surfaces, pastures, arable land and forests. No water bodies are shown. While LANMAP is a more generalised map than e.g. CORINE, the individual polygons are more coherent and larger than in CORINE. The position accuracy of the LANMAP polygons is very good. In Figure 4.3.9 the Uckermark is shown by CORINE data.

Obviously, the identification of pastures by LANMAP in Uckermark is not perfect. While the outlines of pastures often are correct, the attributation as ‘pasture’ is missing. Instead some polygons are marked as ‘arable land’. Also, the larger Uckermark lakes are not represented in LANMAP.

Uckermark is characterized by a high diversity of habitat types (see Figures 5 and 6), often at a small scale. This makes the Uckermark attractive for recreation, but also a home for abundant wildlife. LANMAP gives the impression of a dominant arable land use, which is true in large parts, but misses important additional land use types and does not represent the typical heterogeneity of the landscape.

Figure 4.3.7. Map of the north-east part of the State of Brandenburg, with the city of Berlin and the river Oder to the east bordering the Republic of Poland. Uckermark is within the yellow square, which has a size of 90 x 75 km.

Figure 4.3.8. LANMAP2 map of the Uckermark (see Figure 7).

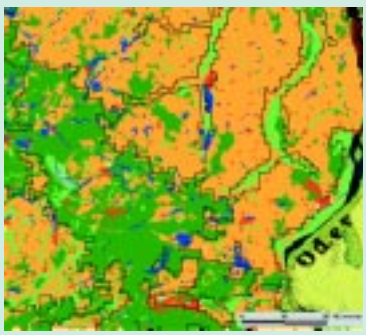
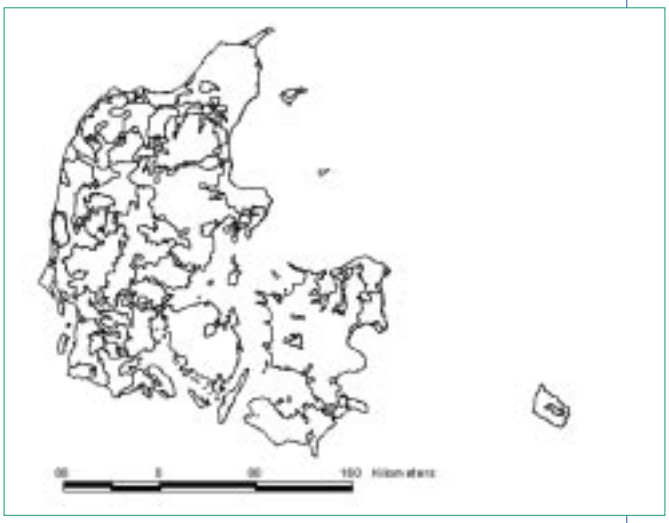


Figure 4.3.9. CORINE map of the Uckermark (see Figure 7).

Denmark

For Denmark 19 landscape types with 1,334 polygons were determined (see Map 4.7). The mean size of area is 33.5 km² (see Table 4.1). Table II.6 (Annex II) gives an overview over these landscape types of the European typology.

According to Table II.6 (Annex II) the Danish landscapes are determined by the following two types: Als_al (Atlantic lowland dominated by sediments and arable land) with 25,926.9 km² (46 polygons) and a share of 58%, and Cls_al (Continental lowland dominated by sediments and arable land) with 13,394.8 km² and a share of 30% of the country's area. Each of the other 17 landscape types covers less than 3% of the territory of Denmark.



MAP 4.7. Landscape types of the European landscape typology map (LANMAP2) for Denmark.

ES1: Spanish Landscape Atlas

Spain is the only participating country where a published atlas of the landscapes exists. In 2003 the "Atlas de los Paisajes de España" was published (Mata Olmo and Sanz Herraíz 2003) aiming at the characterisation and identification of Spanish landscapes. The landscapes are differentiated in three classes of units: landscapes as basic units, landscape types, and associations of landscapes (Caravaca and Sanz Herraíz 2004). The maps are mainly represented in the scale of 1:200000 (Iberian Pensinsula) and 1:50000 (Balearic Islands and Canary Islands). One of the maps represents associations of landscape types in the scale of 1:1 million. In this map 34 associations of landscape types are differentiated with about 1,800 polygons (see Map 4.8): 25 associations for the Iberian Peninsula, three for the Balearic Islands, and six for the Canary Islands. In the European map by means of 67 landscape types the Spanish landscapes of the Iberian Peninsula and the Balearic Islands with about 2,050 polygons are characterised. The Canary Islands are not a part of the European map. Despite of the high number of landscape types in the European map the national typology appears in some cases finer and in some cases coarser (see Map 4.8). The mean size of area in the European typology is with 242.7 km² similar to the national typology with 265.3 km². Table II.7 (see Annex II) represents the European landscape types for Spain.

The following three landscape types are dominant:

- Mmr_al (**M**editerranean **m**ountains dominated by rocks and arable land) with 91,620.7 km² (124 polygons) covering 18.4% of the country's territory;
- Mmr_sh (**M**editerranean **m**ountains dominated by rocks and shrubs and (semi-)natural vegetation) with 70,219.1 km² (62 polygons) and a share of 14.1%; and
- Mmr_fo (**M**editerranean **m**ountains dominated by **r**ocks and **fo**rests) with 49,718.2 km² (51 polygons) and a share of 10% of the territory.

Forty-eight landscape types cover an area less than 1% of the country's area each. The remaining 16 landscape types represent a share between 1% and 7% of the whole territory of Spain each.

The European typology reflects only partly the Spanish landscape types. One reason for the strong distinctions may be the difference in methodologies. The national typology is a result of the combination of spatial analysis, visual interpretation, field work, study and synthesis of abundant historic, geographic and ecological bibliography dealing with territory and landscape analysis, and scientific expertise. In the European map most of the Spanish inland is included within the mountain landscapes (over 500 m) which is a broad generalisation. Furthermore a large amount of the area between 500 m and 1,100 m on the inland of the Iberian Peninsula are plateaus and undulating terrains on sedimentary material. Consequently, a set of Spanish physical and cultural Landscape Character Types, typical of for the plateaus, is missing: "campiñas", páramos (calcareous plateaus) and "paramera". This problem should be addressed. Otherwise the European map would not adequately reflect the landscapes of the Iberian Peninsula. This is not a problem of scale, but rather of concept and criteria. Besides the LANMAP2 does not distinguish between the truly mountain landscapes and those of agricultural and livestock farming high plains. Concerning the land use the categories "shrubs" and "forests" are too generic, especially in the mountain areas of the Central and Cantabrian systems. A comparison between the European types and the national 116 landscape types shows the following main differences: The coastal zones are not distinguished. The very clear differences between humid Atlantic Spain and Mediterranean Spain are not shown. The rural landscape characteristics of inland plateaus do not appear. The differences in the regional character of numerous landscape types arising from the territorial history cannot be appreciated.

MAP 4.8. Map of the associations of landscape types in Spain.

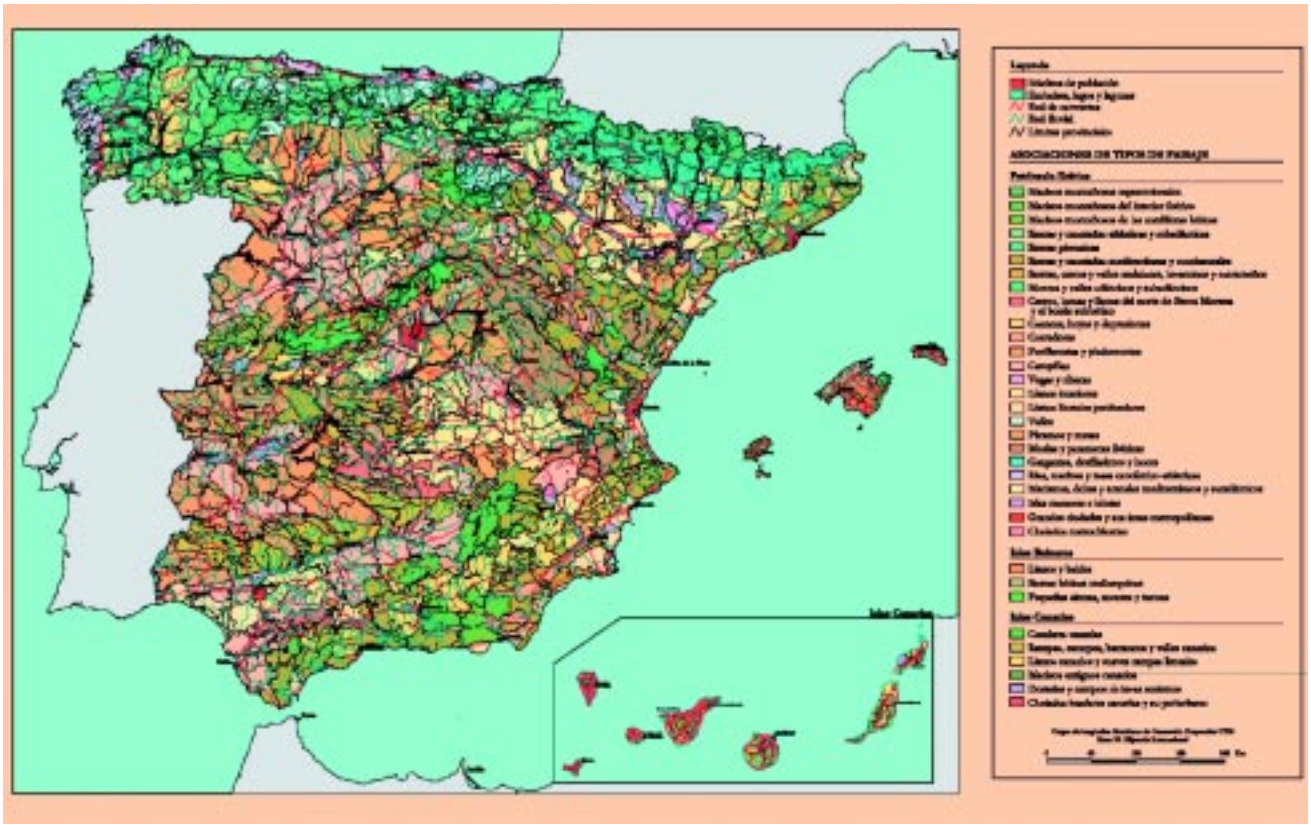
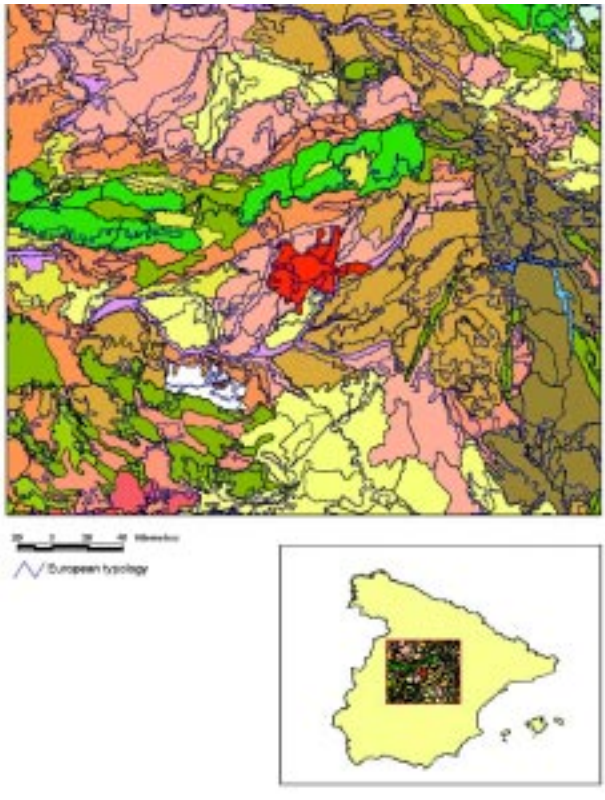


FIGURE 4.6. Comparison between the landscape typology of Spain and the European landscape typology. Enlargement of a section as indicated on the inset map.



When comparing the quality of source data of the European typology with the national information the following problems are encountered: The altitude is insufficient to differentiate types of relief and their incidence in the landscape types. The data source topography does not include information on slopes. The slope should be integrated. The main climate types at the continental scale have not been incorporated. The integration of climate variables like humidity and temperature regimes would be suggested. The predominance of “forests” and “shrubs” over large areas does not always correspond with the reality. Therefore more accurate information on forests and shrubs is needed. Besides information on settlements system is missing in the European database.

France

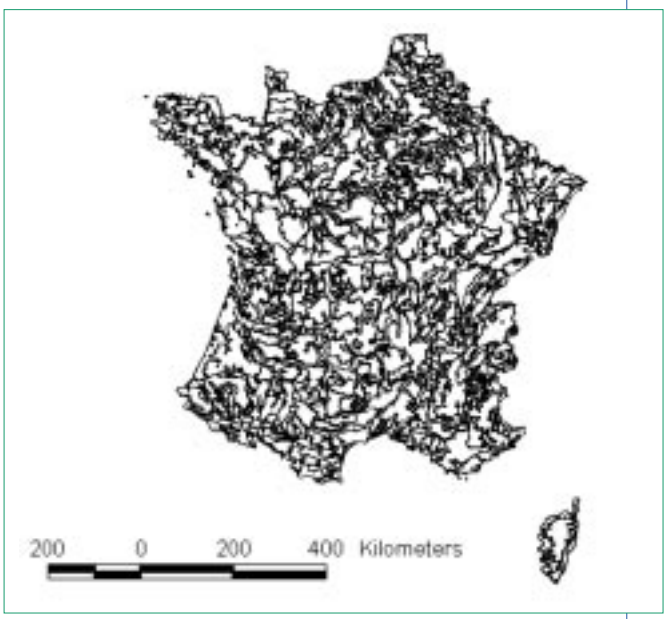
For France 83 landscape types with 2,243 polygons have been determined in the European typology (see Map 4.9). The mean size of area is 244.7 km² (see Table 4.1). Table II.8 (Annex II) gives an overview of the French landscape types.

The following three landscape types are dominant:

- Ahr_al (**A**tlantic **h**ills dominated by **r**ocks and **a**rable land) with 76036.9 km² (70 polygons) with a share of 13.8%;
- Ahs_al (**A**tlantic **h**ills dominated by **s**ediments and **a**rable land) with 53544.7 km² (66 polygons) with a share of 9.8%; and
- Ahr_pa (**A**tlantic **h**ills dominated by rocks and pastures) with 46427.3% (23 polygons) represesenting 8.5% of the French territory.

Each of the other 80 landscape types covers less than 6% of the country.

MAP 4.9. Landscape types of the European landscape typology map (LANMAP2) for France.



BOX 4.4. Landscape Character of Pleine-Fougères area. A case study from north-east of Brittany, France.

The Pleine-Fougères area is located in North-Eastern Brittany, south of Mont Saint Michel Bay, France (48° 36' N, 1° 32' W) (Figure 4.4.1). The substrate is shale with loamy cover for one-third of the area and granite with sandy soil for two-thirds. The area is part of the Armorican Massif that emerged in the Primary Period. Altitude varies from 10 m (shale part) to 130 m (granite parts). Pleine-Fougères area has been a long-term socio-ecological study site for 10 years. The landscape is a hedgerow network landscape, or "bocage" landscape, and the agriculture is dominated by dairy production based on fodder maize, cereals, temporary and permanent grassland. The site was chosen because it displayed a gradient of hedgerows with density decreasing from south to north. This gradient is still present; it is accompanied with a gradient of decreasing grassland surface from south to north (Figure 4.4.2).

Figure 4.4.1.

Figure 4.4.2.

BOX 4.4 continued, Landscape Character of Pleine-Fougères area. A case study from north-east Brittany, France.

Building of the bocage landscape: 19th to early 20th Century

This is the period of the greatest development of hedgerows in this area, as in Brittany in general. Subsistence agriculture developed with poly-breeding-cropping farms of 5–15 ha. Farmhouses and barns made of granite were grouped in rows forming villages (Figure 4.4.3b). As the land passed down through the generations, fields were split into smaller plots (less than 1 ha), delimited by hedgerows. The primary function of hedgerows was therefore to delimit ownership plots. More ancient hedgerows along stream corridors were built to delineate hydromorphic and non-hydromorphic zones (Figure 2): a typical landscape character is therefore a riparian zone delineated by hedgerows on banks and grass as a land cover (Figure 4.4.3e). Woods were scarce and the hedgerows constituted the main source of firewood and timber. Traditionally the proprietor of the field owns the trunk of the trees while the tenant has the right to harvest the branches. Because of this a specific type of pruning (shredding) developed: branches were regularly cut from the bottom to the top of each trunk that reached eight to 12 metres (Figure 4.4.3a). Pruning took place every eight to nine years. Field boundaries were typically made of an earth bank (0.5 to 2.0 m high) with trees (oaks or chestnuts) and diverse shrubs. These hedgerows were not suitable as fences so animals were tethered or kept within the villages. Many hedgerows included a ditch that increased drainage, these still exist today. On granite, erosion, trampling by cattle and passage of carts created sunken roads three to six metres deep, as compared to the land surface (Figure 3c). Remaining sunken roads create unique ecological conditions (cool in summer, no freezing in winter) that are akin to forest microclimate.

Figure 4.4.3a.

Figure 4.4.3b.

Figure 4.4.3c.

Figure 4.4.3d.

Figure 4.4.3e.

Figure 4.4.3f.

BOX 4.4 continued, Landscape Character of Pleine-Fougères area. A case study from north-east Brittany, France.

Agriculture and land development: middle- and late-20th Century

The area became specialised in dairy cow breeding. Farms increased in size through individual land exchanges and the merging of small farms, to reach a size of 30–40 ha. During this development each farm became fragmented and dispersed (Figure 4.4.4). With mechanised development the plot size increased to an average of 1–5 ha. Hedgerows were largely removed (Figure 4.4.5). Land reallotment projects reinforced this process. Nevertheless agriculture and land developed heterogeneously from south to north due to differences in local development initiatives. In the north, the oldest trees were almost all dug out (Figure 4.4.3e). For field management purposes hedgerows were pruned more often along crops but less frequently along grassland (Figure 4.4.3b). Both plot size and farm size increased, while the workforce decreased. Therefore pruning (including wood storage) could take over one month every year for each farm. Permanent grassland became almost restricted to riparian zones.

Figure 4.4.4.

Fifteen farms (each with a different colour)
☐ *Unknown farmer or built-up area.*

Figure 4.4.5.

BOX 4.4 continued, Landscape Character of Pleine-Fougères area. A case study from north-east Brittany, France.

Bocage landscape and agriculture at the crossroads: today's evolution

Dairy farms still predominate, but they have decreased in number, increased in size and decreased in workforce by hectare, as in other regions in the general line of agricultural evolution. About two-thirds of the farms are still using firewood (half of them as the main heating system). There is a discrepancy between the multiple functions associated nowadays with hedgerows by the general public on the one hand, and on the other, the few functions farmers perceive, as well as their capacity to manage them. The recurrent use of glyphosate to manage field margins has been increasing dramatically during recent years, parallel to a decrease in the use of mechanical means: it promotes weed development and erosion of earthen banks (Figure 4.4.6a–b). In the Pleine-Fougères area there is no "terroir product": milk is sold as a standard product to dairy industries. There is no structured firewood market either. So far, landscape policies, co-ordinated notably by Brittany département councils, have been dealing mainly with new hedgerow planting and less with hedgerow management. In other areas of Brittany, local initiatives have promoted investment in new equipment and services to support farmers' hedgerow management (tractor-mounted flail, hedge cutter etc.). Pleine-Fougères community of municipalities recently applied for a "Water, Landscape and Environment" contract aiming at co-ordinating actions for a better integration of agricultural, local and environmental development. This is a new initiative from the Pleine-Fougères département council.

From local landscape description to the European landscape character map

On the European Landscape map (Figure 4.4.7), the area is coded ***Alr_al***, an Atlantic climate with mostly arable land, which is correct. It discriminates this landscape from the other in the region where grassland area is more important. The finer scale approach brings in two important characters: the presence of hedgerows, a common feature to many European Landscapes, and permanent grassland as the dominant land cover in riparian areas. These two landscape characters are important in terms of landscape structures closely related to topography and ecological processes (buffers to arrest stream-bound pollutants coming from upland; corridors for species dispersal).

Figure 4.4.6a.

Figure 4.4.6b.

Figure 4.4.7.

GB1: Landscape types of England

This English map belongs to the second group of national typologies in which landscape types are represented by a letter code comparable to the European typology.

For the United Kingdom a dataset covering only England was available. During the 1990s the former Countryside Commission (then Countryside Agency and meanwhile part of the new governmental body 'Natural England') started up the Countryside Character Initiative (http://www.countryside.gov.uk/LivingLandscapes/countryside_character/index.asp). One result is the landscape character typology in the scale of 1:250000. Seventy-five Landscape Character Types are differentiated with about 1,800 polygons (see Figure 4.7). It is interesting that the used methodology is similar to LANMAP2. So-called Landscape Character Types describe the landscape according to three definitive attributes and are used as a base unit in indicators of change in countryside character and within county or local character assessment. Each landscape is determined by a three-letter code.

In the European landscape typology only 23 landscape types with about 1,200 polygons represent the variety of landscapes in England. The comparison between the national and the European typology shows that the European map is much coarser than the national one (see Map 4.10). The mean size of area in the national typology is with 71.4 km² smaller than in the European one with 102.0 km² (see Table 4.1). Table II.9 (Annex II) gives an overview over the landscape types of the European typology determined for England.

The following five landscape types are dominant:

- Als_ha (**A**tlantic **l**owland dominated by **s**ediments and **h**eterogeneous agricultural areas) with 35,374.3 km² (63 polygons) covering 27.2% of the territory;
- Ahs_pa (**A**tlantic **h**ills dominated by **s**ediments and **pa**stures) with 16301.7 km² (29 polygons) and a share of 12.5%;
- Als_ha (**A**tlantic **l**owland dominated by **s**ediments and heterogeneous agricultural areas) with 15,524.9 km² (62 polygons)representing 11.9%;
- Ahr_pa (**A**tlantic **h**ills dominated by **r**ocks and **p**astures) with 14555.7 km² (33 polygons) and a share of 11.2%; and
- Ahs_al (**A**tlantic **h**ills dominated by **s**ediments and **a**rable **l**and) with 13961.5 km² representing 10.7% of the area of England. The other 18 landscape types cover less than 7% of the area each.

BOX 4.5. Legend-code of English Landscape Types.

The first letter represents the physiography in five attributes:

- high hills (**H**)
- low hills (**U**)
- upland vales and valleys (**V**)
- intermediate (**R**)
- lowlands (**L**).

The second letter gives information about the land cover. The following six land cover classes are differentiated:

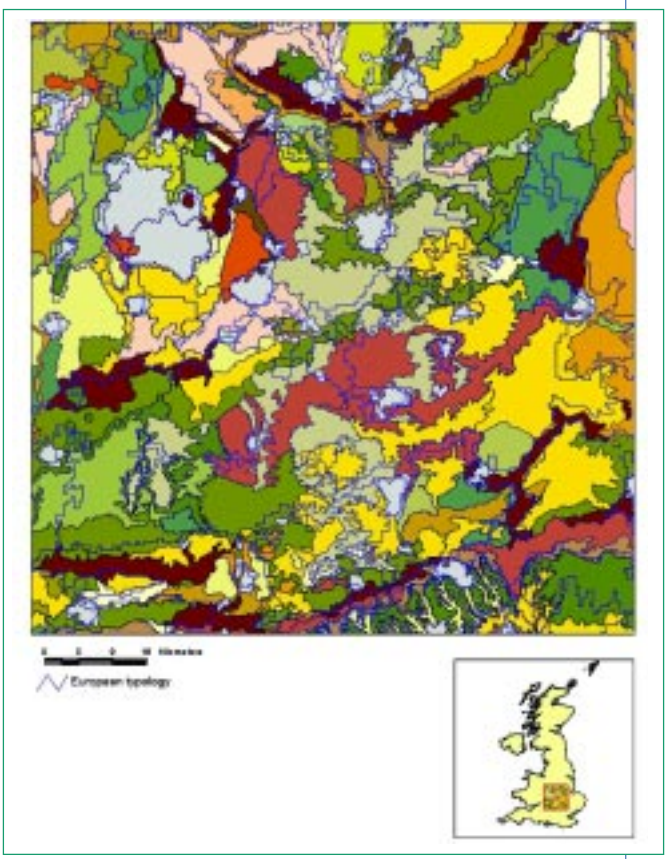
- wetland (**W**)
- health and moorland (**D**)
- chalk and limestone (**L**)
- other light land (**B**)
- clayland (**CP**)
- other heavy land (**P**).

Cultural pattern with nine classes are represented by the third letter. These are:

- wooded-ancient wooded (**A**)
- wooded-estateland (**E**)
- wooded-secondary (**S**)
- dispersed unwooded (**D**)
- nucleated wooded (**N**)
- wetland/waste unwooded (**W**)
- unsettled/open land (**O**)
- coalfields (**C**)
- urban (**Ur**).

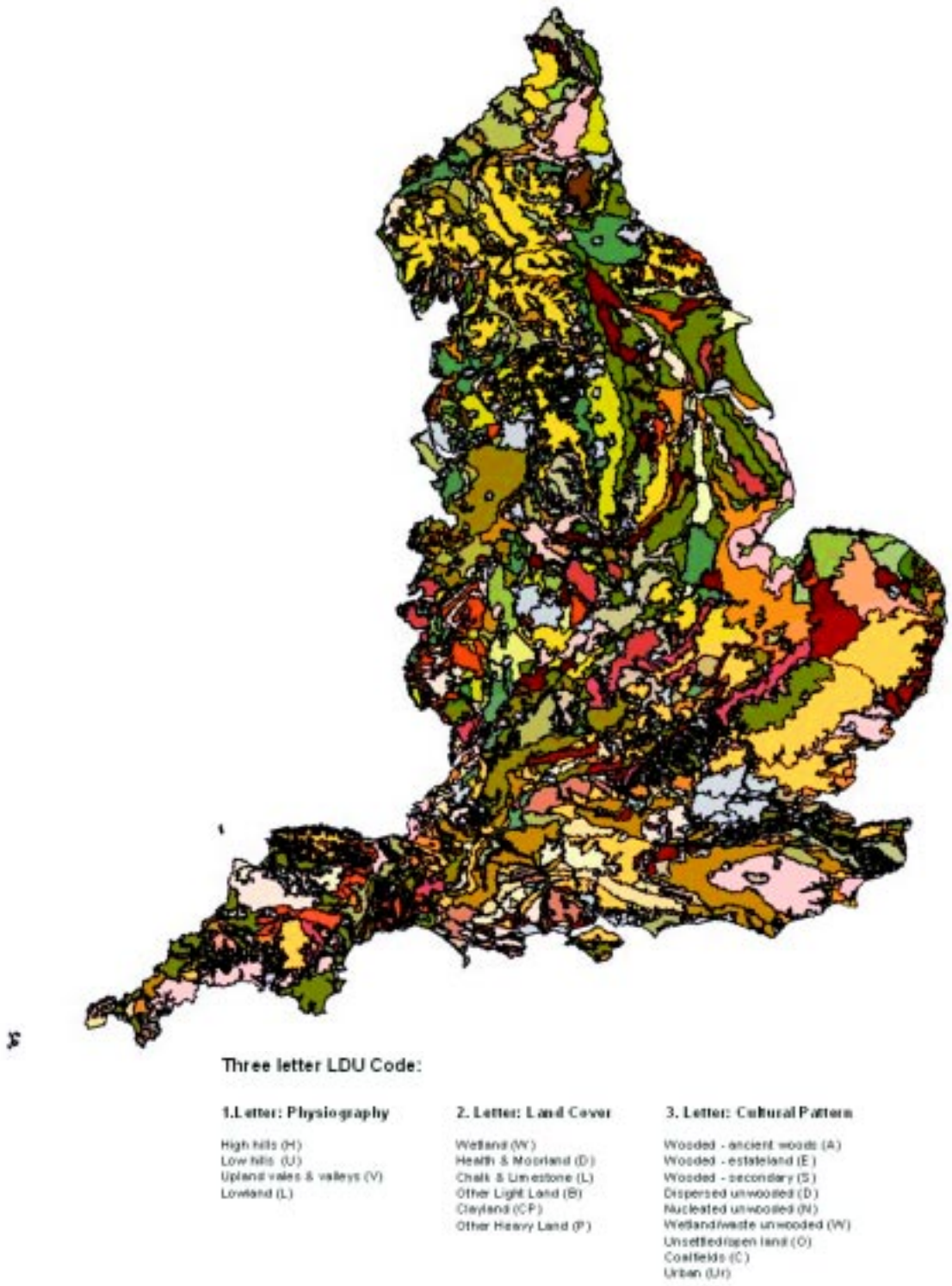
For example, a code of HDO means the landscape type is high hills (H), health and moorland (D) and unsettled/open land (O).

FIGURE 4.7. Comparison between the Landscape Character Types of England and the European landscape typology.



The European typology reflects only partly the national situation. The number of altitude classes is limited and especially it has to be redefined in the lower classes. The choice of boundaries does not coincide with some "national understandings" – thus familiar patterns do not stand out in the European map. So for example in the United Kingdom an altitude of 300 m is usually taken as the boundary between the lowlands and the uplands. Possible categories of lower altitude classes could be lowlands up to 100 m, low hills between 100 m and 300 m and uplands between 300 m and 500 m. It would be useful to integrate settlement patterns into the European typology. In general the classification of the input datasets should be redefined.

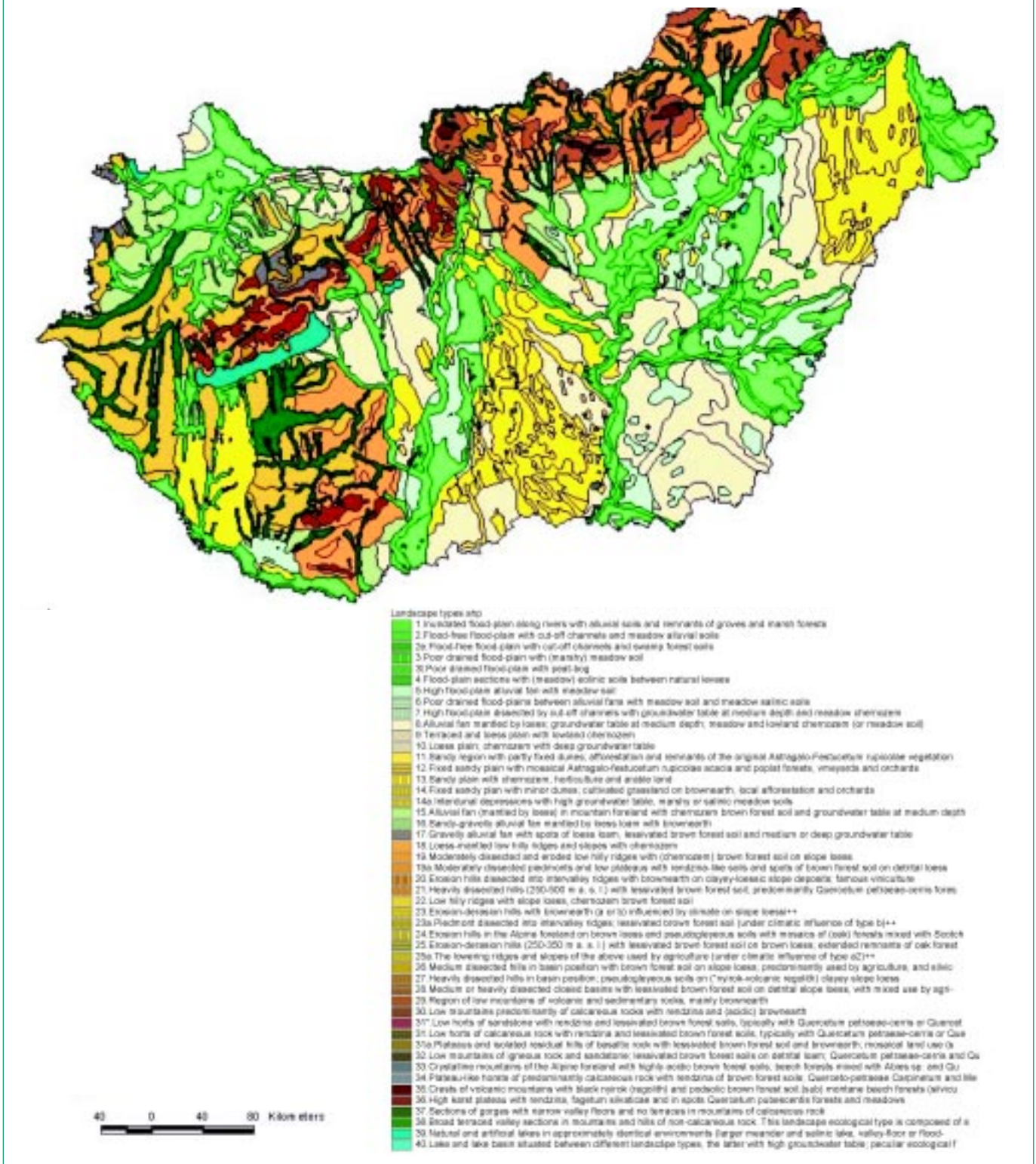
MAP 4.10. Map of the Landscape Character Types in England. Source: The Countryside Agency 2003.



HU2: Landscape types of Hungary

The landscape typology of Hungary on the scale of 1:500000 as a part of the National Atlas of Hungary (1989) includes 48 landscape types, assigned to 14 landscape type groups and four main landscape types, represented by 950 polygons in Map 4.11 and described in Box 4.4. In the European map 25 landscape types represent with about 260 polygons the Hungarian landscapes. The European typology is coarser than the

Map 4.11. Map of the landscape types of Hungary. Source: National Atlas of Hungary (1989); University of Hungary



BOX 4.6. Landscape types of Hungary.

A Plain with moderately continental climate; landscape types dominantly used by agriculture

I. Alluvial plain; cultivated grassland with high groundwater table and hydromorphous soils

1 Inundated flood-plain along rivers with alluvial soils and remnants of groves and marsh forests
2 Flood-free flood-plain with out-off channels and meadow alluvial soils or swamp forest soils (2e)
3 Poor drained flood-plain with (marshy) meadow soil and peat-bog (3t)
4 Flood-plain sections with (meadow) eolinic soils between natural levees

II. Alluvial plain; cultivated grassland predominantly with groundwater table at medium depth and meadow chernozems

5 High flood-plain alluvial fan with meadow soil
6 Poorly drained flood-plains between alluvial fans with meadow soil and meadow saline soils
7 High flood-plain dissected by cut-off channels with groundwater table at medium depth and meadow chernozem

III. Loess plain in basin position; cultivated grassland with chernozems

8 Alluvial fan mantled by loess; groundwater table at medium depth; meadow and lowland chernozem (or meadow soil)
9 Terraced and loess plain with lowland chernozem
10 Loess plain; chernozem with deep groundwater table

IV. Alluvial fan with blown sand; cultivated grassland with mosaic of vineyards, orchards and forests; medium or deep groundwater table

11 Sandy region with partly fixed dunes; afforestation and remnants of the original Astragalo-Festucetum rupicolae vegetation
12 Fixed sandy plain with mosaic Astragalo-Festucetum rupicolae acacia and poplar forests, vineyards and orchards
13 Sandy plain with chernozem; horticulture and arable land
14 Fixed sandy plan with minor dunes; cultivated grassland on brown earth, local afforestation and orchards
14a Inter-dune depressions with high groundwater table, marshy or saline meadow soils

V. Alluvial fan on basin margin; cultivated grassland of dense drainage network; mosaic remnants of Quercetum petraeae-cerris forests chernozem and forest soils

15 Alluvial fan (mantled by loess) in mountain foreland with chernozem brown forest soil and groundwater table at medium depth
16 Sandy-gravel alluvial fan mantled by loess loam with brown earth
17 Gravely alluvial fan with spots of loess loam, lessivated brown forest soil and medium or deep groundwater table

B Erosion landscape types dominantly used by agri- and silviculture and locally by industry

VI. Piedmonts and hills; dissected by erosion-derasion valleys; cultivated grassland with mosaic vineyards and orchards and Quercetum petraeae-cerris forests and deep groundwater table

18 Loess-mantled low hilly ridges and slopes with chernozem
19 Moderately dissected and eroded low hilly ridges with (chernozem) brown forest soil on slope loess
19a Moderately dissected piedmonts and low plateaus with rendzina-like soils and spots of brown forest soil on detrital loess
20 Erosion hills dissected into inter-valley ridges with brown earth on clayey-loess slope deposits; famous viniculture
21 Heavily dissected hills (250–500 m a.s.l.) with lessivated brown forest soil; predominantly Quercetum petraeae-cerris forests and Querceto-petraeae Carpinetum on higher hilly ridges

VII. Independent hilly regions dissected by erosion-derasion valleys; mostly cultivated grassland with deep groundwater table; vineyards and major remnants of mixed forests

22 Low hilly ridges with slope loess, chernozem brown forest soil
23 Erosion-derasion hills with brown earth (a or b) influenced by climate on slope loess++
24 Piedmont dissected into inter-valley ridges; lessivated brown forest soil (under climatic influence of type b)++
25 Erosion hills in the Alpine foreland on brown loess and pseudogley soils with mosaics of (oak) forests mixed with Scots pine (*Pinus silvestris*) partly used by agriculture (under climatic influence of type c)++
26 Erosion-derasion hills (250–350 m a. s. l.) with lessivated brown forest soil on brown loess; extended remnants of oak forests with beech and hornbeam; partly used by agriculture (under climatic influence of type b)++
25a The lowering ridges and slopes of the above used by agriculture (under climatic influence of type a2)++

C Forested landscape types in mountains of medium height

VIII. Smaller hills in intermountain basins; cultivated grasslands with remnants of Quercetum-petraeae-cerris forests and deep groundwater table+++

26 Medium dissected hills in basin position with brown forest soil on slope loess; predominantly used by agriculture, and silviculture and mining
27 Heavily dissected hills in basin position; pseudogley soils on (“nyirok”-volcanic regolith) clayey slope loess
28 Medium or heavily dissected closed basins with lessivated brown forest soil on detrital slope loess, with mixed use by agri- and silviculture and mining

IX. Smaller hills in intermountain basins; cultivated grasslands with remnants of Quercetum-petraeae-cerris forests and deep groundwater table+++

29 Medium dissected hills in basin position with brown forest soil on slope loess; predominantly used by agriculture, and silviculture and mining
30 Heavily dissected hills in basin position; pseudogley soils on (“nyirok”-volcanic regolith) clayey slope loess

Continued

BOX 4.6 continued, Landscape types of Hungary.

31 Medium or heavily dissected closed basins with lessivated brown forest soil on detrital slope loess, with mixed use by agri- and silviculture and mining

IX. Low mountains predominantly under sub-continental climatic influence; Quercetum-petraeae-cerris and Querceto-petraeae Carpinetum forests (below 650 m a.s.l.)

29 Region of low mountains of volcanic and sedimentary rocks; mainly brown earth
30 Low mountains predominantly of calcareous rocks with rendzina and (acidic) brown earth

X. Low mountains under additional sub-Atlantic and sub-Mediterranean climatic influence; Quercetum petraeae-cerris and Querceto-petraeae Carpinetum forests

31 Low horts of calcareous rock or sandstone (31") with rendzina and lessivated brown forest soils, typically with Quercetum petraeae-cerris or Querceto petraeae Carpinetum forests and mosaic (beech and) Quercetum pubescentis forests
31a Plateaus and isolated residual hills of basaltic rock with lessivated brown forest soil and brown earth; mosaic land use (silvi-, agri- and horticulture locally with quarrying)
32 Low mountains of igneous rock and sandstone; lessivated brown forest soils on detrital loam; Quercetum petraeae-cerrís and Querceto-petraeae Carpinetum forests

XI. Low mountains with forests mainly under sub-Atlantic climatic influence

33 Crystalline mountains of the Alpine foreland with highly acidic brown forest soils; beech forests mixed with *Abies* sp. and Querceto-petraeae Carpinetum forests
34 Plateau-like horsts of predominantly calcareous rock with rendzina of brown forest soils; Querceto-petraeae Carpinetum and Melitti fagetum silvaticae forests

XII. Mountains of medium height under cooler and humid climate with Fagetum silvaticae hungaricum forests

35 Crests of volcanic mountains with black "nyirok" (regolith) and podsol brown forest soil;(sub) mountain beech forests (silviculture with tourist and recreational use)
36 High karst plateau with rendzina, fagetum silvaticae and in spots Quercetum pubescentis forests and meadows

D Some peculiar landscape types

XIII. Major valleys within various hilly or mountainous landscape types

37 Sections of gorges with narrow valley floors and no terraces in mountains of calcareous rock
38 Broad terraced valley sections in mountains and hills of non-calcareous rock. This landscape ecological type is composed of several different but among them homogeneous groups of ecological facies

XIV. Lake and perilacustric type

39 Natural and artificial lakes in approximately identical environments (larger meander and saline lake, valley-floor or flood-plain reservoir)
40 Lake and lake basin situated between different landscape types, the latter with high groundwater table; peculiar ecological facies (offshore bars, reed-beds, marsh etc.) The lakes Balaton, Ferto and Velence.

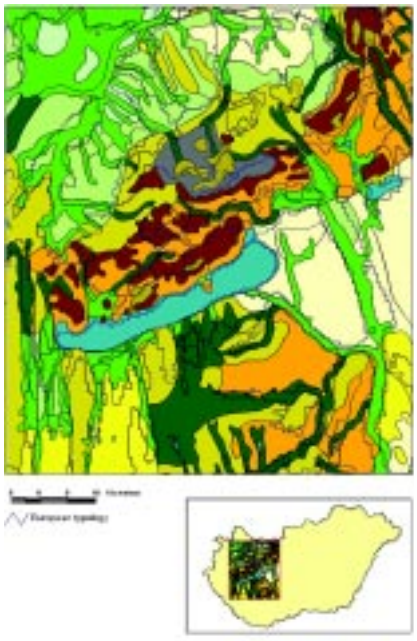
national one (see Figure 4.8). The mean size of area in the national typology is with about 98 km² considerably smaller than in the European one with a mean size of 360 km². Table II.10 (see Annex II) gives an overview over all European landscape types determined for Hungary.

The three dominant landscape types are:

- Chs_al (**C**ontinental **h**ills dominated by **s**ediments and **a**rable **l**and) with an area of 50,493 km² (103 polygons) covering 54.2% of the country's territory;
- Cls_al (**C**ontinental **l**owland dominated by **s**ediments and **a**rable **l**and) with 21,519 km² (20 polygons) and a share of 23.1%; and
- Chs_fo (**C**ontinental **h**ills dominated by **s**edimentss and **f**orests) with 10541.3 km² and a share of 11.3% of the total area of Hungary.

Each of the other 22 landscape types covers less than 3% of the country. Comparing both typologies the following aspects have to be mentioned: as regards the location of landscape units the European typology is quite different from the national one. In general the European landscape types do not reflect the Hungarian situation even though the national typology is based on the same attributes. Therefore it will be necessary to reconsider and reclassify all input datasets to improve the typology.

FIGURE 4.8. Comparison between the landscape typology of Hungary and the European landscape typology. Enlargement of a section as indicated on the inset map.



BOX 4.7. Landscape Character of the Zemplén-mountain. A case study from north-east Hungary.

Zemplén is the most eastern part of the low and medium high mountain range of the Carpathian-basin, straggling from southwest to the north-east. (Figure4.7.1) This region is registered in the geographical landscape distribution of Hungary as a sub-Carpathian volcanic area, bordered by river basins.

This classification is based mainly on geomorphology and climate conditions, as well as on land cover data. This corresponds well with the LANMAP2 methodological approach as the European typology puts also much emphasis on geological, topographical and climate factors as well land cover. Nevertheless, the European representation of this region is surprisingly different from the national one, as the mountains below 1,000 m are listed between the hills and volcanic rocks are not represented in the Hungarian relevant section. This example illustrates the need for some targeted modification and refinement to make LANMAP2 a reliable tool for putting national landscapes into a macro-regional and continental context as well as for giving an overview of transfrontier landscapes.

Although the Hungarian geographical landscape classifications and descriptions are highly accurate in the sense of landscape's natural constitution, there are not character assessments, as cultural elements are not sufficiently represented and visual aspects are lacking. In the following example we give a short summary of a characterisation made within a Hungarian research project aiming to draw up a new landscape planning system.

Figures 4.7.1 and 4.7.2. Location of the Zemplén Case Study Area.

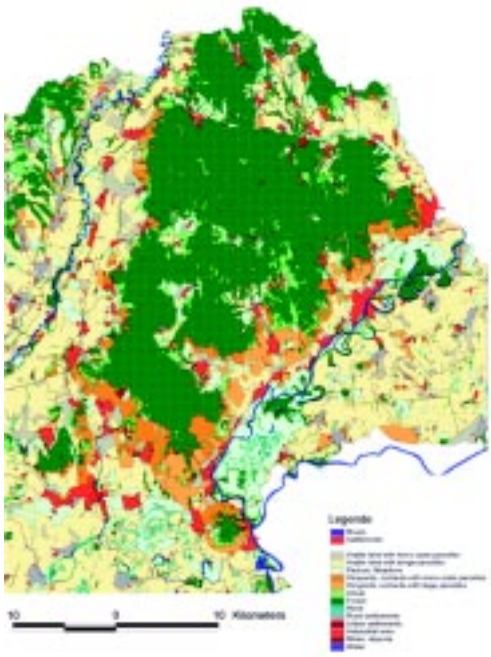


Figure 4.7.3.

The whole territory of the Zemplén-mountains is characterised by diverse landforms, various hydrological, soil conditions and accordingly different land-cover systems and settlement distribution. (Figure 4.7.3.) Therefore geomorphology is the main factor of the landscape character and responsible for the division of the character areas within the region.

Zemplén consist of four character area: the massifs of the Central Zemplén (Photo 4.7.1); the large half basin pushing into the massifs in the north-eastern part, called "Hegyköz" (Intermountains) (Photo 4.7.2); the southern piedmonts "Tokaj", the famous wine region (Photo 4.7.3), and the western confine called piedmonts "Abaúj"(Photo 4.7.4). The several glorious remains of the national history, fortresses, castles parks, churches occurring in all character areas give a considerable time-depth to the landscape. (Photos 4.7.5–4.7.7)

Photo 4.7.4.

Photo 4.7.5.

BOX 4.7 continued, Landscape Character of the Zemplén-mountain. A case study from north-east Hungary.

Photo 4.7.1.

Photo 4.7.2.

Photo 4.7.3.

Photo 4.7.6.

Photo 4.7.7.

The Central Zemplén area is a 300–700 m high, sparsely populated, closed mountain landscape, covered mainly by natural and semi-natural oak forest. Open patches of pastures and arable land can only be found in the narrow valleys and small basins environ the little villages settled around the manufacturers during the 18th century. As only very little industrial activity is still existing in the area, land abandonment is an ongoing process in the last decades. The growing interest towards eco-tourism might probably help stopping the depopulation of the villages, however more and more old rural houses transform into secondary residences (Photo 4.7.8–9).

The character area Hegyköz is a half basin encircled by a range of volcanic copes. The slightly undulated surface of the basin is open ploughed- and grassland divided by forested patches and belts along the little streams. The arable lands and grasses are also partly abandoned; the different phases of the natural succession processes can be found. (Photo 4.7.11–12) The little villages are settled in the transition zone of the basin and the mountains. (Photo 4.7.13) They are good examples of settlement's ideal visual insertion into the landscape. Apart from the moderate land abandonment this character area is a various, peaceful, harmonious landscape, where a broad overview is everywhere possible. Central Zemplén and northern part of Hegyköz are designated as landscape protection areas and one of the main goals of the conservation is the maintenance of the species-rich pastures and meadows. The development interests of the growing tourism are sometimes conflicting with the nature conservation.

The piedmonts are similar concerning landforms and settlement distribution, but land uses are rather different. Between the lowest areas of the river basins and the mountains two benches divide the piedmonts with two chain of settlement on them. These landforms, as well as roads and villages give a clearly visible zonal distribution to the landscape. There is a forest and pasture belt along the rivers, small and dissected along Hernád, but broad and continuous along Bodrog in the southern part. (Photo 4.7.14) The first bench is the place of the one settlement chain, close to the rivers, encircled with arable lands, the second bench is at a higher elevation where the famous vineyards of the Tokaj region appear. Tokaj, the southern piedmont area, has recently become part of the UNESCO World Heritage List as cultural landscape (Photo 4.7.15). The main characteristic of Tokaj is of course the viticulture, which is lacking on the western piedmonts Abaúj. Tokaj is a very complex, diverse landscape, with many cultural and historical elements, but Abaúj is more homogenous area. In the piedmont area there are several, sometimes conflicting policy aspects concerning Tokaj cultural landscape as world heritage, as the new designated Natura 2000 sites as well as environmentally sensitive areas.

The character description of the Zemplén region shows directions for the further development of the European Landscape Character Map. A need for a more refined assessment of the geomorphology and the land-cover repartition, the involvement of information about settlement and infrastructure network (urban or rural areas, compact or disperse settlements etc.) as well as on historical aspects emerged.

Photo 4.7.8.

Photo 4.7.9.

Photo 4.7.10.

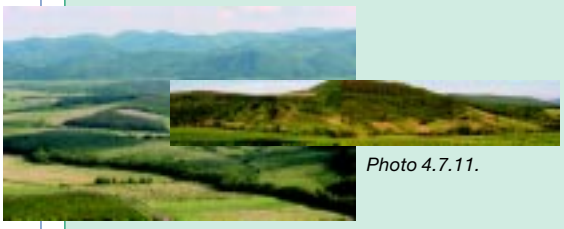


Photo 4.7.11.

Photo 4.7.12.

Photo 4.7.13.

Photo 4.7.14.

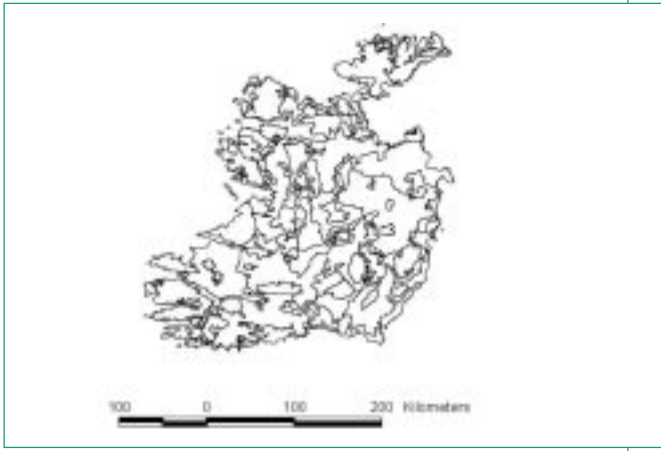
Ireland

In the European landscape typology (see Map 4.12) the landscapes of Ireland are represented by 30 landscape types with 1,311 polygons (see Annex II, Table II.11). The mean size of area is 53,4% (see Table 4.1).

There are two dominant landscape types:

- Alr_pa (**A**tlantic lowland dominated by **r**ocks and **p**astures) with 30063.5 km² (45 polygons) covering 42.9% of the country, and
- Ahr_pa (**A**tlantic hills dominated by **r**ocks and **p**astures) with 17920.6 km² (37 polygons) and a share of 25.6% of the territory.

Each of the other 28 landscape types covers less than 9% of the country.

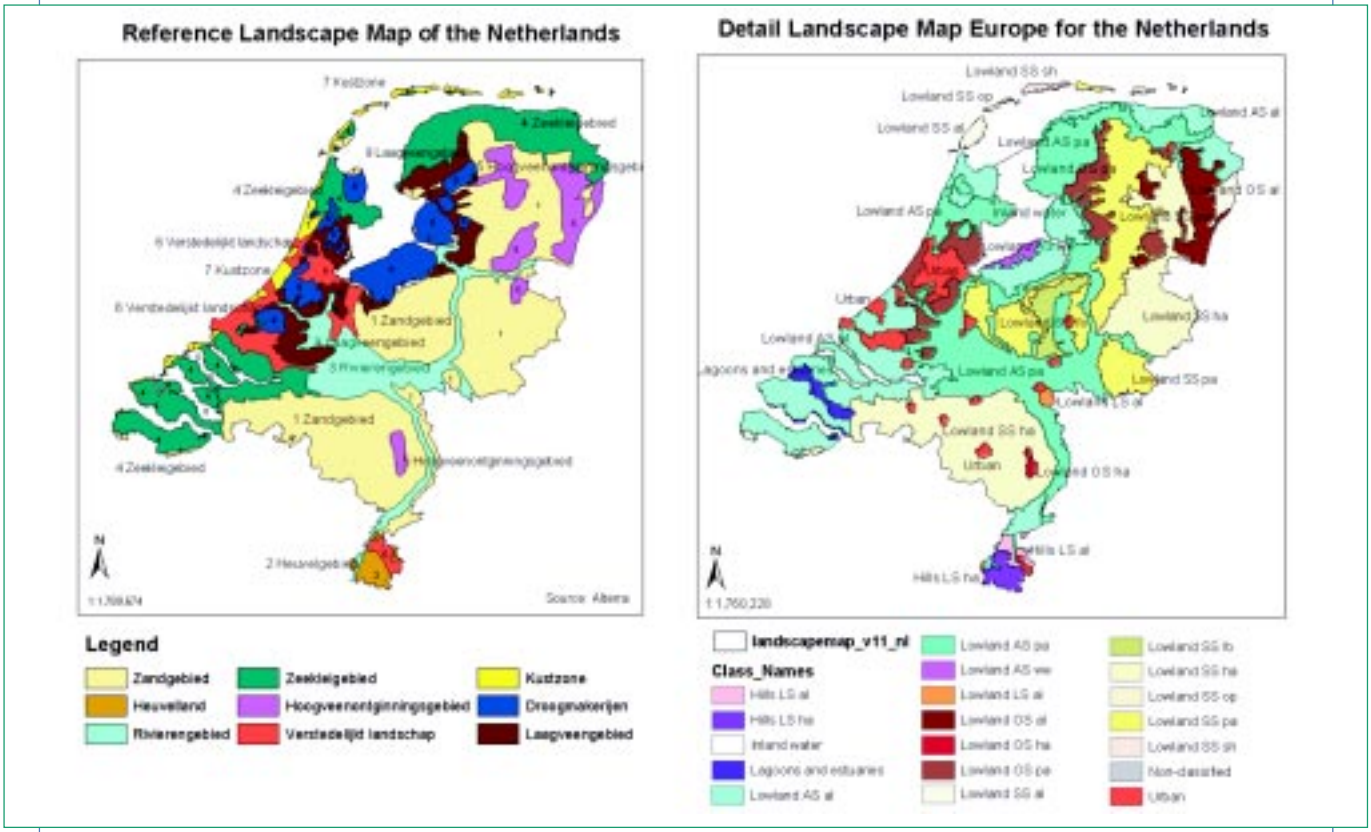


MAP 4.12. Landscape types of the European landscape typology map (LANMAP2) for Ireland.

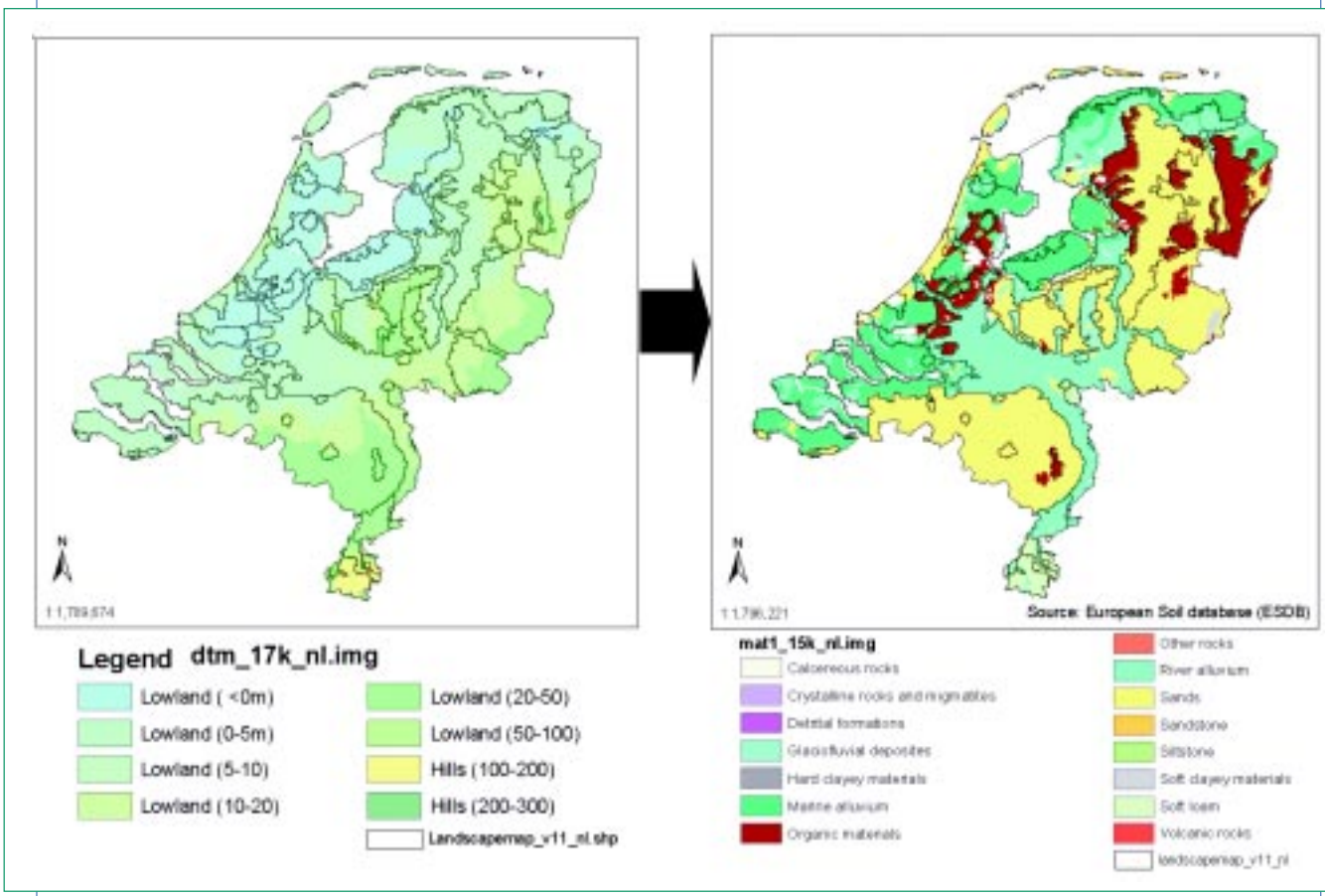
NL2: Landscape types of the Netherlands

The landscape typology of the Netherlands (Ministerie van Lanbouw en Visserij 1992) has nine landscape types with a total of 112 polygons shown in Map 4.13a. In LANMAP2 19 landscape types with about 650 polygons are determined for this country (see Annex II, Table II.12). The comparison between both typologies shows that the European typology is finer than the national one (see Figure 4.9). The mean size of area is with 53 km² in the European map much smaller than in the national one with 337 km². The European landscape types do reflect very well the Dutch "Ecodistricten" of the project "Landscape ecological survey of the Netherlands; landscape typology" (1996–1998).

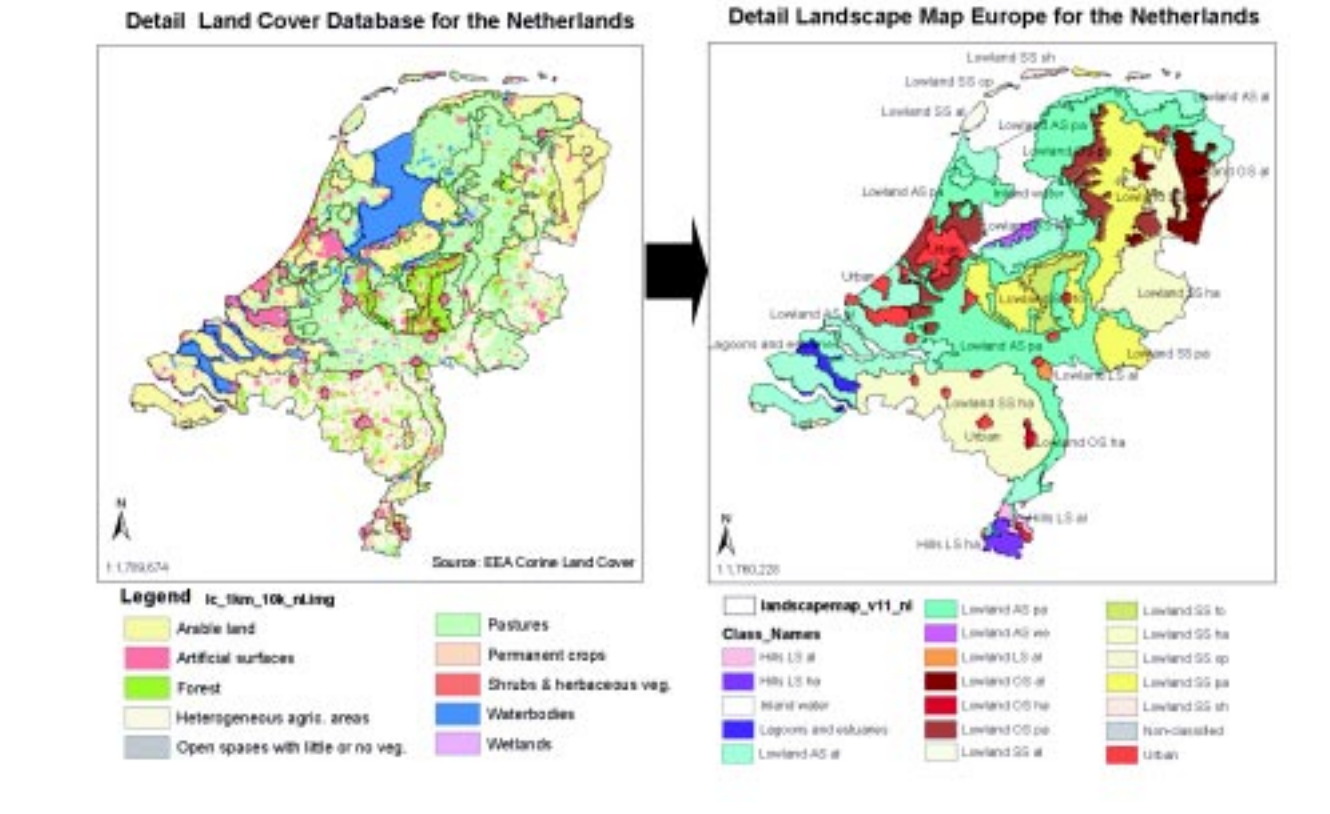
Map 4.13a. Map comparison of the landscape types of the Netherlands with LANMAP1. Source: Ministerie van Landbouw en Visserij (LNV) 1992. Nota landschap. Regeringsbeslissing visie landschap. Publisher Den Haag.



Map 4.13b. Map comparison DEM Netherlands with European Soil Database.



Map 4.13c. Map CORINE land cover for the Netherlands with LANMAP1.



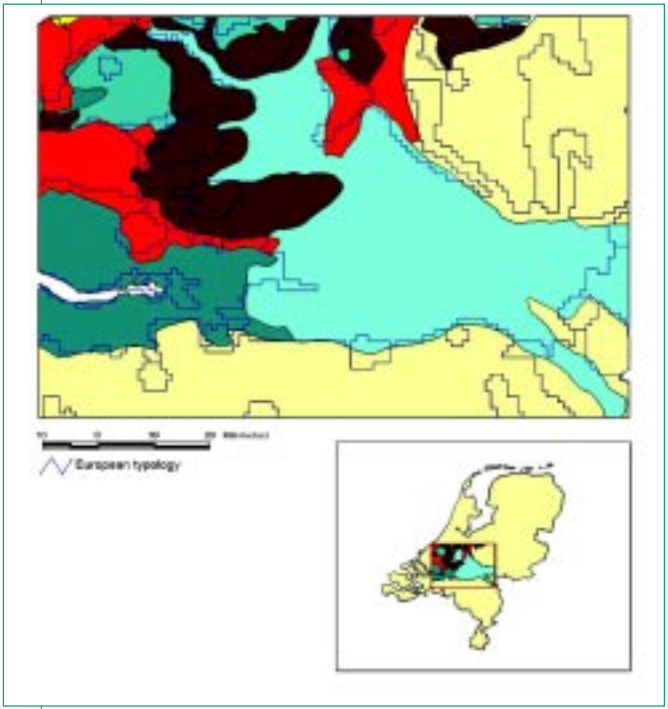


FIGURE 4.9. Comparison between the landscape typology of the Netherlands and the European landscape typology. Enlargement of a section as indicated on the inset map.

The three dominant landscape types in the Netherlands are:

- Als_pa (**A**tlantic **l**owland dominated by **s**ediments and **p**astures) with 14165.8 km² (26 polygons) covering 40.2% of the whole territory
- Als_al (Atlantic lowland dominated by **s**ediments and **a**rable **l**and) with an area of 8295.4 km² (50 polygons) and a share of 23.6%; and
- Als_ha (**A**tlantic **l**owland dominated by **s**ediments and **h**eterogeneous **a**gricultural areas).

Each of the other 16 landscape types covers less than 7% of the area of the Netherlands.

A check for the above described classification with the standard Dutch landscape classification teaches us that, taken into account the scale of the European landscape map (1:5 million), the boundaries between the major landscapes are present. In the western part of the Netherlands the lowland areas consisting of alluvial and organic sediments with arable land and pastures are clearly recognisable. In the central and eastern part the same picture exists for the sandy sediments.

NO1: The Norwegian landscape reference system

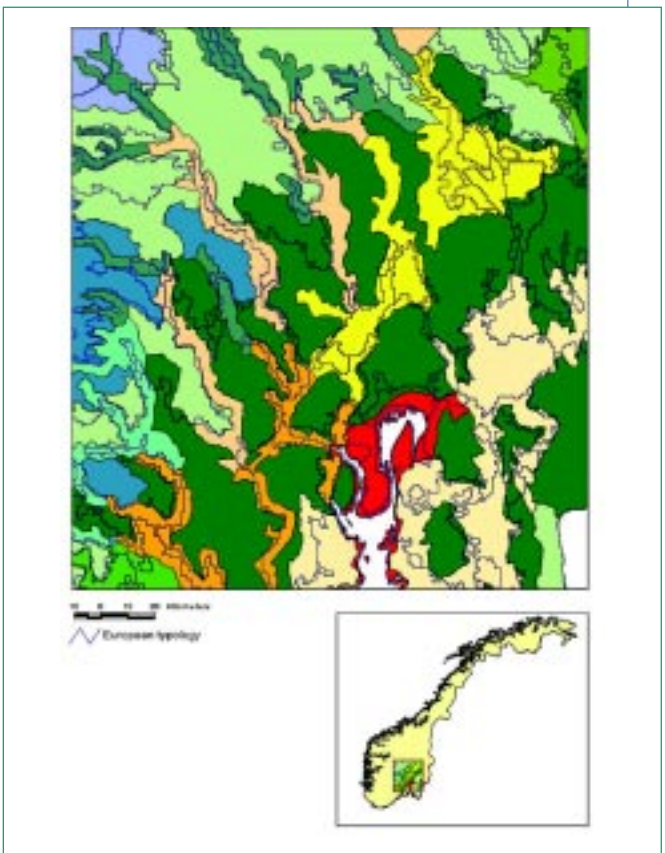
In Norway a map of the landscape regions in the scale of 1:2 million was developed in the 1990s (Elgersma 1996; Puschmann 1998). 45 landscape regions are used to describe the landscapes of this country. These landscape regions are subdivided into 436 sub regions (see Map 4.14) with 1,100 polygons. In the European typology 67 landscape types are determined with about 8,000 polygons. The comparison between the national and the European classification represents the differences between both (see Figure 4.10). The mean area in the national classification is with 292 km² much coarser than in the European typology with 39 km².

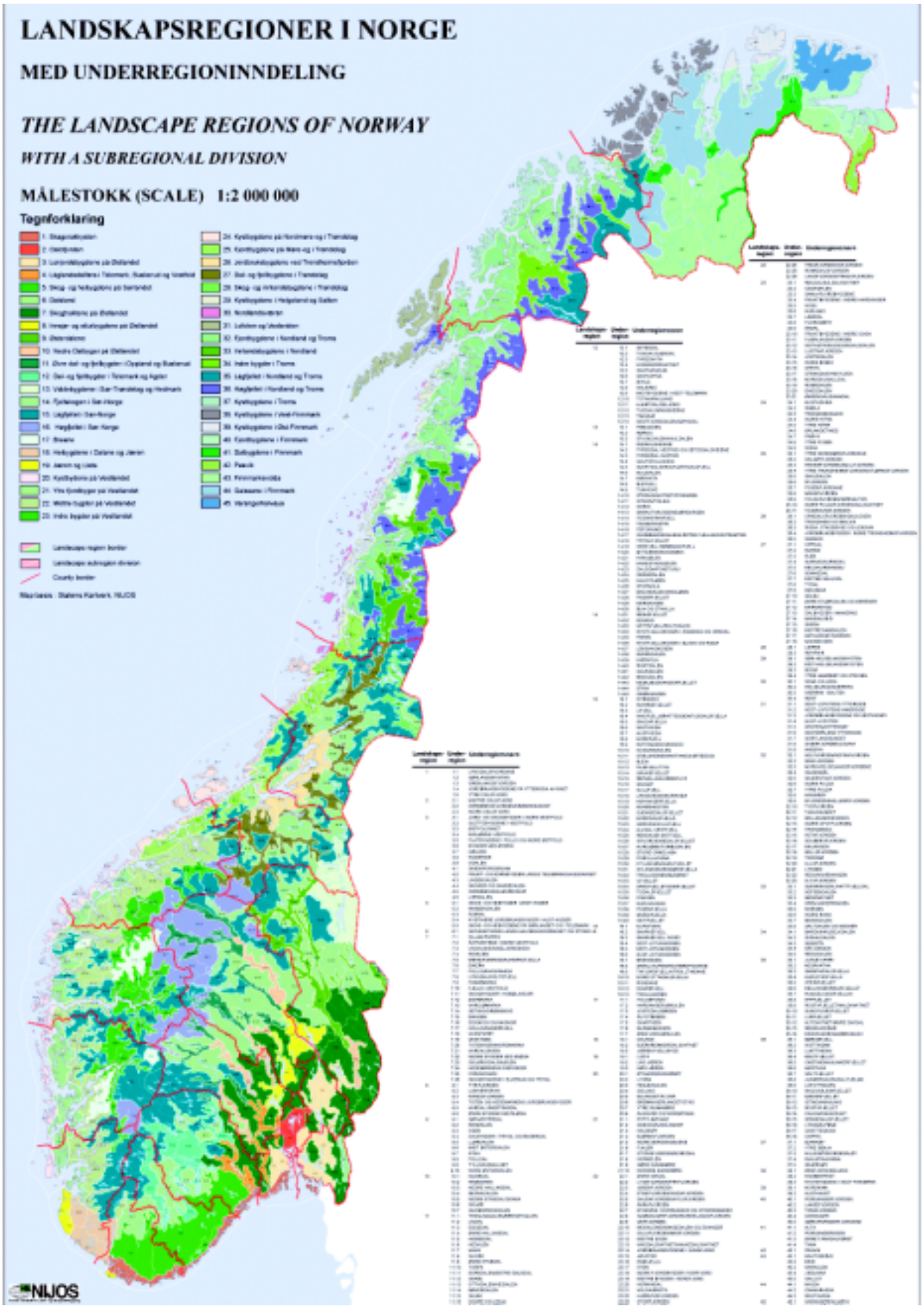
The landscape types of the European landscape typology, their frequency and the covered area you find in Table II.13 (see Annex II). The following landscape types are dominant in Norway:

- Zhs_sh (**A**lpine **h**ills dominated by **s**ediments and **sh**rubs and (semi-)natural vegetation) with 63043.8 km² (400 polygons) covering 19.3% of the country's territory;
- Bms_sh (**B**oreal **m**ountains dominated by **s**ediments and **s**hrubs and (semi-)natural vegetation) with 39114 km² (nine polygons) with a share of 12.0%; and
- Zms_op (**A**lpine **m**ountains dominated by **s**ediments and **op**en spaces with little or no vegetation) with 35664.0 km² (84 polygons) and a share of 10.0%.

Each of the 50 other landscape types covers an area of less than 1%. The remaining 14 landscape types represent between 1% and 10% of the country's area each.

FIGURE 4.10. Comparison between the landscape typology of Norway and the European landscape typology.





MAP 4.14. Map of the landscape regions of Norway with a sub-regional division.

The delineation of the European landscape types does not correspond with the national landscape regions and with the conditions on the ground. For example, the generalisation of input data has led to a classification of the Lofoten islands as lowlands/hills when in fact the flat lowland shoreline is backed by dramatic 1,000 m peaks. Concerning the land cover the European classification must be considered as rather inaccurate. Most of the country is classified as “shrubs and (semi-)natural vegetation” including important agricultural areas from central and the south-western part of the country and large forest areas. Therefore the land cover input data have to be improved and the classes have to be redefined. All themes have some strange aspects, e.g. the boreal and the artic zones in the north and the area of rocks are smaller than expected. The area with continental climate on the south coast would normally be classified as nemoral/boreo-nemoral in Norway whilst dry areas (in the northern boreal and alpine zones) in central Norway and on the plains of the far north are usually defined as “slightly continental”.

PT1: Landscape characterisation of Portugal

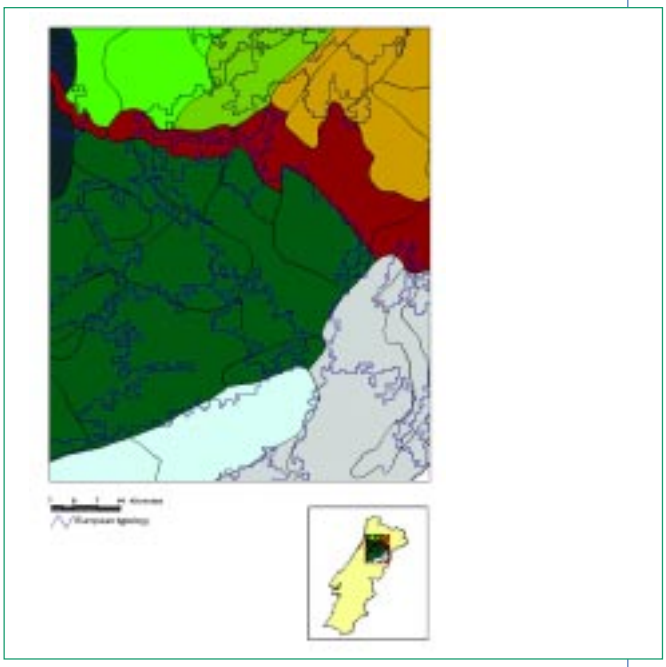
The landscapes of Portugal are represented by 128 landscape units assigned to 22 landscape groups with about 230 polygons in a map on the scale 1:250000 (see Map 4.15). Box 4.8 gives an overview over these landscape units and groups of landscape units. The Landscape Character Assessment for Portugal was made aiming at the identification of the landscape character in each unit. Therefore there is no national typology. Different methodological approaches used for the national and the European classification are the cause that there are no similarities concerning the results. In the European map 34 landscape types with about 470 polygons form the Portuguese landscapes. The national classification is coarser than the European one (see Figure 4.11). The mean size of area in the national classification is 386 km² and in the European one 187 km². In Table II.14 (see Annex II) the landscape types of the European landscape typology for Portugal are listed.

The dominant landscape types for Portugal are:

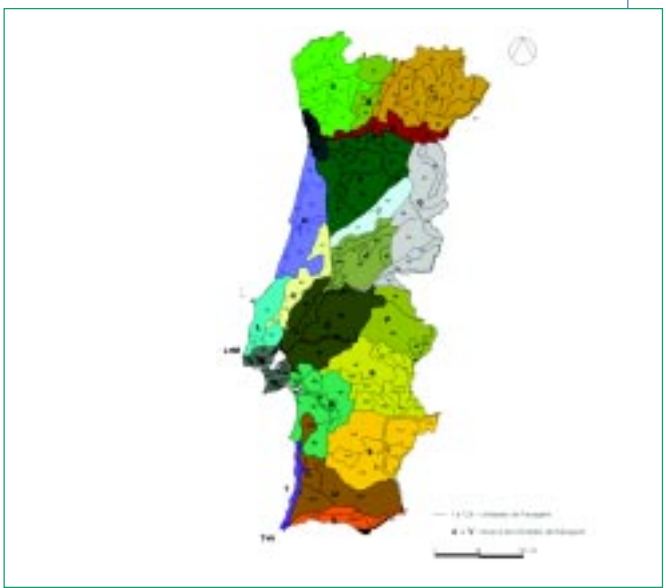
- Mhr_al (**M**editerranean **h**ills dominated by **r**ocks and **a**rable **l**and) with 14619.8 km² (19 polygons) representing 16.5% of the country’s area;
- Ahr_fo (**A**tlantic **h**ills dominated by **r**ocks and **fo**rests) with 11091.4 km² (six polygons) and a share of 12.5%; and
- Mmr_ha (**M**editerranean **m**ountains dominated by **r**ocks and **h**eterogeneous **a**gricultural areas) with 9916.1 km² and a share of 11.2% of the territory.

In order to more accurately reflect the national approach, the European input data should have been combined with some indicators on climate/water availability. Thus, some area under the same type are rather different from each other and their inclusion in a specific type is rather problematic. The generalisation has been undertaken rather rough, for example the Douro valley under shrub or most of Alentejo under forest or under arable land – there should be a land use type for vineyard and one for silvo-pastoral systems.

FIGURE 4.11. Comparison between the landscape typology of Portugal and the European landscape typolgy. Enlargement of a section as indicated on the inset map.



MAP 4.15. Map of landscape units and groups of landscape units in Portugal.



BOX 4.8. Landscape Units and Groups of Landscape Units in Portugal.

A – Entre Douro e Minho
- 1 – Vale do Minho
- 2 – Entre Minho e Lima
- 3 – Vale do Lima
- 4 – Entre Lima e Cávado
- 5 – Vale do Cávado
- 6 – Entre Cávado e Ave
- 7 – Vale do Ave
- 8 – Serra da Aboboreira
- 9 – Serras do Minho
- 10 – Serra da Cabreira e Montelongo
- 11 – Minho interior
- 12 – Baixo Tâmega e Sousa

B – Montes entre Larouco e Marão
- 13 – Serras do Larouco e Barroso
- 14 – Terras de Basto
- 15 – Serras do Marão e Alvão

C – Trás-os-Montes
- 16 – Veiga de Chaves
- 17 – Vale do Corgo
- 18 – Serras da Falperra e Padrela
- 19 – Terra Fria Transmontana
- 20 – Baixa de Valpaços
- 21 – Terras de Bragança e Macedo de Calvaleiros
- 22 – Vale do Sabor
- 23 – Planalto Mirandês
- 24 – Douro Internacional
- 25 – Terra Quente Transmontana
- 26 – Serras de Bornes
- 27 – Baixo Tua e Ansiães
- 28 – Baixo Sabor e Terras Altas de Moncorvo

D – Área Metropolitana do Porto
- 29 – Litoral a Norte do Porto?
- 30 – Grande Porto
- 31 – Espinho/Feira/S. João da Madeira?

E – Douro
- 32 – Baixo Douro
- 33 – Riba-Douro
- 34 – Douro Vinhateiro
- 35 – Alto Douro

F – Beira Alta
- 36 – Baixo Paiva
- 37 – Serra de Montemuro
- 38 – Pomares de Lamego e Moimenta da Beira?
- 39 – Planalto de Penedono
- 40 – Serra da Arada
- 41 – Montes Ocidentais da Beira Alta?
- 42 – Alto Paiva e Vouga
- 43 – Serras de Leomil e Lapa
- 44 – Serra do Caramulo
- 45 – Dão e Médio Mondego
- 46 – Cova de Celorico

G – Beira Interior
- 47 – Planalto da Beira Transmontana
- 48 – Vale do Côa
- 49 – Cova da Beira
- 50 – Penha Garcia e Serra da Malcata
- 51 – Campo de Castelo Branco ou Campo entre C. Branco e Monsanto?
- 52 – Campina da Idanha
- 53 – Extremo da Beira Interior – Tejo?
- 54 – Tejo Superior Encaixado
- 55 – Terras de Nisa

H – Beira Litoral
- 56 – Ria de Aveiro e Baixo Vouga
- 57 – Pinhal Litoral Aveiro – Nazaré
- 58 – Bairrada e ... (pinhal...)?
- 59 – Baixo Mondego e Coimbra
- 60 – Beira Litoral Sul?

I – Maciço Central
- 61 – Serras da Lousã e Açor
- 62 – Serra da Estrela

J – Pinhal do Centro
- 63 – Pinhal Interior
- 64 – Vale do Zêzere
- 65 – Serras da Gardunha, de Alvelos e do Moradal
- 66 – Mosaico agrícola e florestal a Oeste de Castelo Branco

K – Maciço Calcário da Estremadura
- 67 – Maciço Calcário entre Coimbra e Tomar?
- 68 – Serras de Aire e Candeeiros
- 69 – Colinas de Rio Maior?
- 70 – Serra de Montejunto

L – Estremadura – Oeste
- 71 – Oeste
- 72 – Oeste Interior – Alenquer?
- 73 – Oeste Sul?

M – Área Metropolitana de Lisboa – Norte
- 74 – Terra Saloia?
- 75 – Serra de Sintra
- 76 – Linha de Sintra
- 77 – Lisboa
- 78 – Costa do Sol –Guincho

N – Área Metropolitana de Lisboa – Sul
- 79 – Arco Ribeirinho Almada – Montijo
- 80 – Outra-Banda?
- 81 – Charneca da Lagoa de Albufeira
- 82 – Serra da Arrábida

O – Ribatejo
- 83 – Colinas do Ribatejo
- 84 – Médio Tejo
- 85 – Vale do Tejo – Lezíria
- 86 – Charneca Ribatejana
- 87 – Vale do Sorraia

P – Alto Alentejo
- 88 – Serra de S. Mamede
- 89 – Peneplanície do Alto Alentejo
- 90 – Colinas de Elvas
- 91 – Várzeas do Caia e Juromenha

Q – Terras do Sado
- 92 – Areias de Pegões
- 93 – Estuário do Sado
- 94 – Charneca do Sado
- 95 – Pinhais do Alentejo Litoral
- 96 – Vale do Baixo Sado
- 97 – Montados da Bacia do Sado
- 98 – Terras do Alto Sado

R – Alentejo Central
- 99 – Montados do Alentejo Central?
- 100 – Maciço Calcário Estremoz-Borba-Vila Viçosa
- 101 – Serra de Ossa
- 102 – Terras de Alandroal e Terena
- 103 – Serra do Monfurado
- 104 – Planície aberta – Sul de Évora
- 105 – Campos de Reguengos de Monsaraz
- 106 – Albufeira de Alqueva e envolventes
- 107 – Terras de Amareleja – Mourão
- 108 – Terras de Viana – Alvito
- 109 – Serra de Portel

S – Baixo Alentejo
- 110 – Terras Fortes do Baixo Alentejo
- 111 – Vale do Baixo Guadiana e afluentes
- 112 – Olivais de Moura e Serpa
- 113 – Barrancos
- 114 – Campo Branco de Castro Verde
- 115 – Campos de Ourique – Almodôvar – Mértola
- 116 – Serra de Serpa e Mértola

T – Costa Alentejana e Sudoeste Vicentino
- 117 – Litoral Alentejano e Vicentino
- 118 – Vale do Mira
- 119 – Ponta de Sagres e Cabo de São Vicente

U – Serras do Algarve e do Litoral Alentejano
- 120 – Serras de Grândola e do Cercal
- 121 – Colinas de Odemira
- 122 – Serras do Sul ou Serras de Odemira e Caldeirão até Guadina?
- 123 – Serra de Monchique e Envolventes

V – Algarve
- 124 – Barlavento Algarvio
- 125 – Barrocal Algarvio
- 126 – Litoral do Centro Algarvio
- 127 – Ria Formosa
- 128 – Foz do Guadiana

4.4 Comparison of national classifications/typologies between neighbouring countries

In addition to the description and cartographic representation of the single national landscape classifications/typologies in the previous section, a direct comparison between the national classifications of neighbouring countries has been undertaken.

Based on the unique database of the ELCAI project, four multi-national regions have been created representing two or three neighbouring countries. These regions cover the following countries:

- Netherlands – Belgium – Germany;
- Germany – Switzerland – Austria;
- Austria – Hungary; and
- Portugal – Spain.

Bearing in mind the different methodologies and input parameter, the intention is to demonstrate the differences between the national landscape typologies especially concerning their spatial resolution.

In Figure 4.12 the national landscape classifications of the Netherlands, Belgium and Germany are represented in one map. The spatial resolution of the Landscape Character Types of Belgium is much finer than in the Netherlands and Germany. Within all national classifications the map of Belgium is the finest one based on pixels of a size of 1 km x 1 km. In comparison with it the landscape types of the Netherlands and Germany appear coarse. An adjustment between these three classifications would not be possible. The spatial resolution of the Dutch typology is very coarse whereas the German one is a little bit finer.

The national landscape classifications of Germany, Switzerland and Austria are represented in Figure 4.13. These three classifications represent three different methodological approaches resulting in three maps of distinct spatial resolution. In comparison to the very fine pixel based Austrian classification the classification of Germany and Switzerland appear coarse. The Swiss landscape typology based on a certain kind of "administrative" units, the so-called mobile spatial regions, is an exception to all other classification. It would be impossible to adjust these three classifications.

In Figure 4.14 the distinctions between the very fine national classification of Austria and the coarser one of Hungary are visible. The spatial resolution of the determined landscape types is very different.

The national classifications of Portugal and Spain are represented in Figure 4.15. The Spanish classification is finer than the Portuguese one. But it may be that the two countries are able to adjust their classifications. In all other cases an adjustment appears impossible and unsolvable.

FIGURE 4.12. Map of the national landscape classifications/ typologies of the Netherlands, Belgium and Germany.

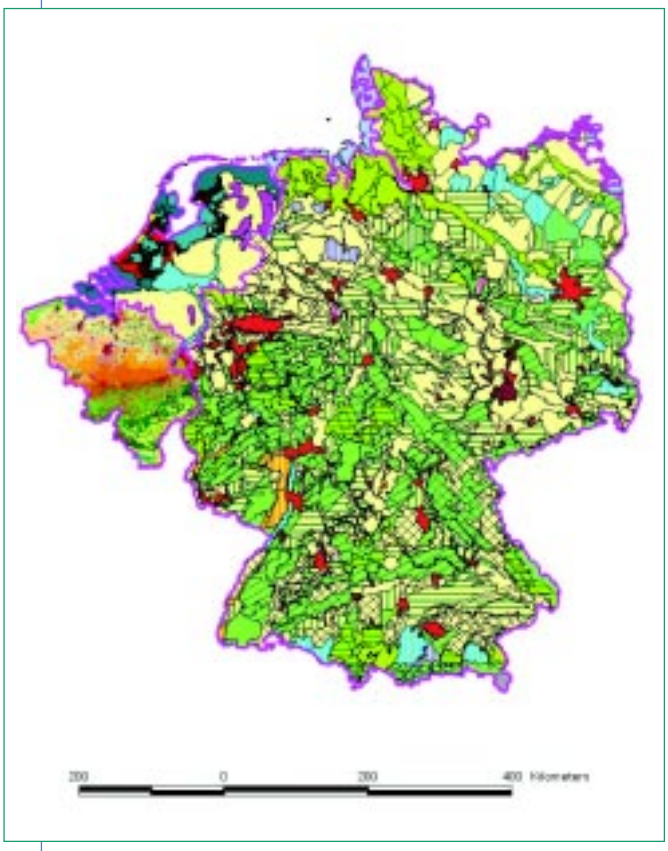
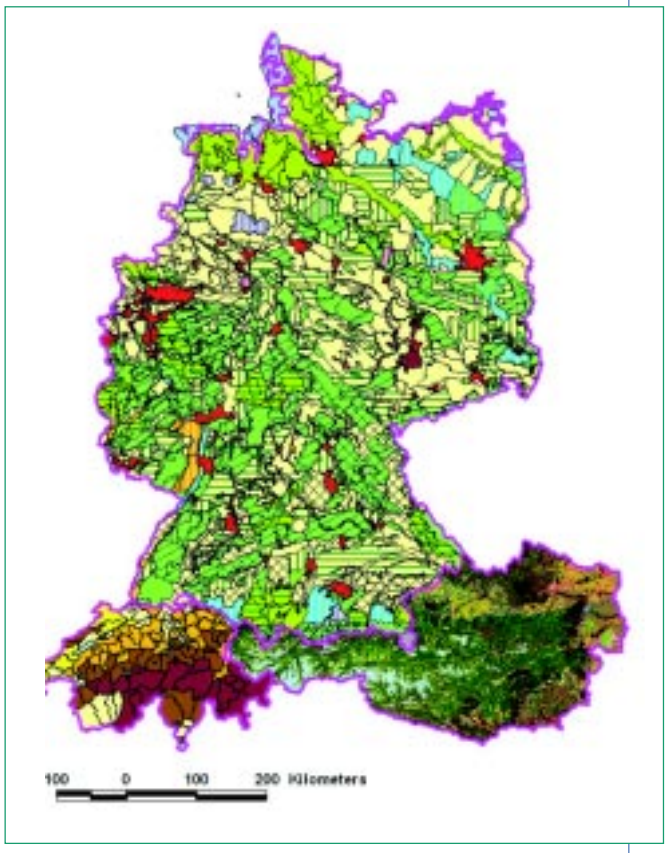


FIGURE 4.13. Map of the national landscape classifications/ typologies of Germany, Switzerland and Austria.



The comparison of landscape classifications between neighbouring countries demonstrates their distinctions and the lack of common standards. To overcome these two problems the only consequence is to develop a harmonised landscape map for whole Europe.

Landscapes can exceed local, regional or national borders. In general landscape classification are made for a region or a country. Each country has its own experience and expertise concerning the used input parameters and the methodology. The results of this process are manifold. On the one hand, as to be expected, great distinctions between the national landscape classifications occur. On the other hand, these distinctions make investigations in cross-border landscape difficult.

In view of the wide range of global environmental problems, there is a clear need for transfrontier thinking, especially in the case of a landscape assessment. The above mentioned distinctions between the national landscape classifications are wide and their adjustment appears unsolvable. Besides there do not exist national classifications in all European countries like France, Denmark and Ireland for example. With the European landscape map LANMAP2 developed within the ELCAI project a first important step has been done to provide a standardised landscape typology map covering whole Europe. Such a European-wide landscape typology has two advantages. The first one is: all countries have a standardised national classification at their disposal based on the same input parameter, the same spatial resolution, and the same time. The second advantage is as follows: distinctions between national classifications concerning transfrontier landscapes are excluded because the landscape types are not determined and limited by administrative units.

FIGURE 4.15. Map of the national landscape classifications/ typologies of Portugal and Spain.

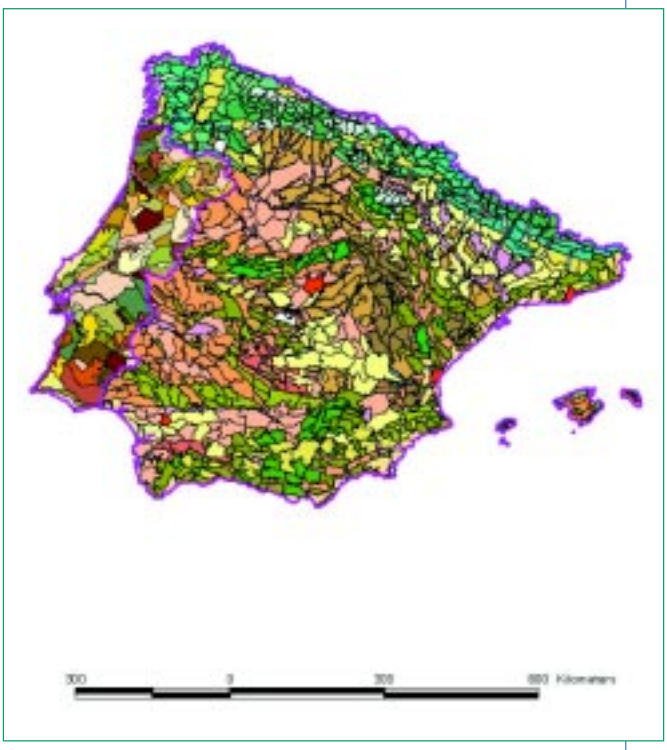
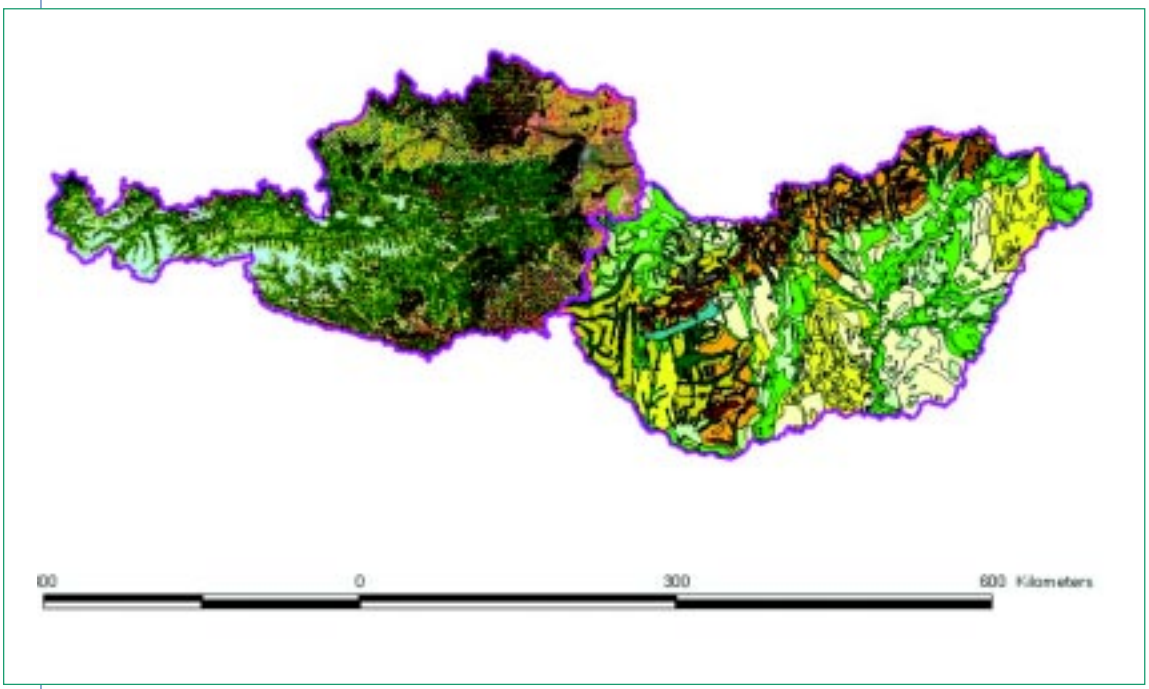


FIGURE 4.14. Map of the national landscape classifications/typologies of Austria and Hungary.



4.5 Results of the questionnaires on LANMAP2

One aim of this work programme was to expose the first European landscape typology and map (LANMAP2) to a critical group of geographers, landscape ecologists, landscape planners, decision makers to form their opinion about it. By means of a questionnaire (see Annex III for details) the methodology, the input data sets, the typology and the map should be evaluated and critically reviewed. The possible outcome of this exercise includes some comments concerning the improvement of the typology and map by integrating additional data sets, by redefining the altitude classes and so on. The main objective consists in maintaining a European-wide accepted landscape typology and map for scientific and policy purposes.

At first all participants were asked to compare the LANMAP2 with their national classifications and typologies which are suitable for such a comparison.

Therefore a questionnaire was generated. This questionnaire for evaluating status and development options of the European Landscape Typology Map consists of the following three parts with a total of nine separate questions (see Annex III – Questionnaire):

I. Basic evaluation (four questions)
II. Principle Assessment on the basis of national data sets (two questions)
III. Specific assessment and suggestions (three questions).

All 14 project partners gave their feedback:

Alterra	(Netherlands)
CAU	(Czech Republic)
IECB	(Austria)
IMAR	(Portugal)
INB	(Belgium)
INRA	(France)
LAI	(Ireland)
NERI	(Denmark)
NIJOS	(Norway)
UAM	(Spain)
UFZ	(Germany)
UNOT	(United Kingdom)
UWH	(Hungary)
WSL	(Switzerland)
ZALF	(Germany)

The questionnaires were analysed in detail and the results are explained as follows: the answers of single questions are very different from partner to partner and reflect the diverse evaluations from their specific national point of view based on their own experiences comparing the LANMAP 2 with national classifications.

4.5.1 Basic evaluation

This part consists of four questions which have to be answered and commented.

Question 1:
Does the European landscape classification and map capture essential components of the landscape at the European level as defined in ELCAI?

Answer	ALTERRA	CAU	IECB	IMAR	INB	INRA	LAI	NERI	NIJOS	UAM	UFZ	UNOT	UWH	WSL	ZALF	Σ
Yes	•	•	•		•		•									5
No				•				•								2
Partly						•	•		•	•	•	•	•	•	•	9

The majority of partners responded that the European landscape classification and map captures only partly the landscape at the European level. For Portugal and Denmark the European map does not capture essential components of the landscape.

The LANMAP2 gives a consistent view across Europe and provides a common language and classification system. With the input parameters parent material, topography, climate and land cover some essential characteristics necessary for a European landscape typology have been applied. But important features of landscapes such as linear elements are not yet addressed Furthermore certain economic as well as key social aspects are missing. The topographical typology is not accurate enough, as the altitude and parent materials are not enough for representing landforms and geomorphologic characteristics. A redefinition of classes should be considered, e.g. lowlands up to 100 m, low hills 100 m to 300 m, then uplands >300 m to 500 m. Moreover the slope should be incorporated to define the relief, currently only the altitude has been considered.

The map is certainly a starting point for a European landscape classification but it does not cover relevant issues such as landscape structure, management and (multi-)functionality. Forming a basis for a consistent European landscape typology, more indicators will be necessary to capture landscape characteristics. However, the question remains whether such a characterisation is feasible as part of a European classification.

Question 2:
Should further components (e.g. hydrological, biotic, non-biophysical) be integrated into such a classification?

Answer	ALTERRA	CAU	IECB	IMAR	INB	INRA	LAI	NERI	NIJOS	UAM	UFZ	UNOT	UWH	WSL	ZALF	Σ
Yes	•	•	•	•	•	•	•		-	•	•		•	•	•	12
No									-							0
Partly								•	-			•				2

Most of the partners agree that further components should be integrated. But the complexity has to be considered, e.g. the more classification types there are the greater the risk of losing the common framework. There is a need to balance these two aspects.

Biodiversity relevant issues such as protected areas as well as tourism and traffic relevant data are missing. The aggregation of parent material to only four classes results in highly aggregated landscape types. A redefinition into a few more classes would be useful.

Soil types and the precipitation should be incorporated. The natural potential vegetation of Europe (Bohn *et al.*

2004) as an integrative characteristic of landscapes should be a component for creating landscape types. Information about landscape history, cultural-historical aspects, visual aspects, aesthetics, environmental conflict or hazard zones are considered to be assets. Population density, settlement density, infrastructure density can be probably integrated in one attribute.

Question 3:
Do you accept the cartographic representation of the landscape typology?

Answer	ALTERRA	CAU	IECB	IMAR	INB	INRA	LAI	NERI	NIJOS	UAM	UFZ	UNOT	UWH	WSL	ZALF	Σ
Yes	•	•	•	•			•		-			•	•	•	•	9
No									-							0
Partly					•	•		•	•	•	•					6

The map represents a big progress towards a European landscape typology. The main differences between large European landscapes based on given datasets are well visible. It is the first consistent approach to a European landscape classification based on descriptors for primary and secondary landscape structures. Because of scale issues, the cartographic representation of a European map cannot be the same as it would be on the national level. From a European perspective the map is absolutely adequate as it shows most of the relevant physiographic features and includes aspects of land use as well.

The cartographic representation of the climatic zones by means of colours reflects very well the basic pattern of the spatial structure of landscape types from the north to the south, and from the west to the east as well as in vertical direction in the alpine region. But sometimes it is difficult to distinguish between closely related shades of colour. The different symbols (combination of letters) for each landscape type must be clearly positioned in the map. A generalisation of landscape borders should be made. The map legend could be more clearly provided.

Some data corrections have to be made. Some landscape types contain boundaries that split on landscape type in several spatial units with the same attributes. There are also some problems concerning the coastline mask of Denmark. Many Danish significant islands and peninsulas have been tagged with wrong attributes.

Question 4:
For what purposes is the LANMAP2 suitable? Give some examples please (e.g. assessment of suitability for cultivation, recreation, erosion hazard, …).

The answer of this question demonstrates different purposes and can be summarised as follows:
The typology and map give an overview of European landscapes and provide a background and a common language for monitoring landscape trends at European level, e.g. the effects of global warming, the effects of urbanisation, transportation, monitoring the success of forestry, agriculture and cover related policies. It is useful to investigate the diversity of the physical environment across Europe. The map could be used for the development of landscape and land use change scenarios or hypotheses according to expected global changes and possible political reactions. A further purpose could be the strategic landscape planning on the European scale, landscape protection, biodiversity and landscape diversity protection. The map provides a general overview for European policies: rural development, environmental, nature and landscape conservation strategies.

The map is mainly useful for assessments at the European level. For national and regional purposes more detailed information is desirable. Furthermore the typology and map could be applied for education at all levels.

4.5.2 Principle assessment on the basis of national data sets

Question 5:
When comparing the European classification and map with your national/regional approache(s), which differences need to be considered the most relevant?

a) Scale
b) Typology criteria
c) Number of types
d) Location of units (unit boundaries)
e) Source data
f) Method/Aggregation that has been applied.

Answer	ALTERRA	CAU	IECB	IMAR	INB	INRA	LAI	NERI	NIJOS	UAM	UFZ	UNOT	UWH	WSL	ZALF	Σ
Scale	•	•	•	•	•	•	•		•	•	•	•		•		12
Typology criteria	•	•		•	•	•			•	•	•	•		•		10
Number of types					•		•			•	•	•	•	•		7
Location of units		•	•	•	•	•	•	•	•	•	•	•	•			12
Source data	•		•		•	•			•		•		•	•		8
Method/ aggregation	•	•	•	•	•				•	•	•	•		•	•	11

The answers of Question 5 demonstrate that the selected criteria are considered as important with respect to differences between the national/regional and the European approaches. There is no criterion without any relevance. The majority of partners argue that the scale, the typology criteria, the location of units, and the applied method are the most relevant criteria causing differences between the national/regional and the European classifications. The number of types has relevance only for seven partners. The source data are relevant for eight partners.

The national and regional classifications are more accurate compared to the European one. This is due to larger scales and more detailed input datasets. As a consequence the number of landscape types varies and more landscape types are defined in national/regional classifications than in the European map. The latter represents a higher degree of generalisation. It could not be expected that a European map reflects all details of national or regional maps. It must be distinguished

between different geographic dimensions: the European, national and regional one. Different geographic dimensions require various geographic approaches whereas each dimension represents a certain degree of aggregation and generalisation. The used typology criteria have also a great importance for the different landscape typology because they influence the kind of landscape typology. For example the Swiss landscape typology includes in addition to the criteria of LANMAP2 landscape heritage aspects and biodiversity relevant data. Other typologies of Switzerland involve socio-economic data on the community-level. In Belgium the relief variation and the heterogeneity are included in the landscape typology. Moreover the accuracy of the used criteria and their arrangement in groups determines the landscape typology. So the climate divisions used in LANMAP2 do not reflect the climatic situation in Denmark very much. The unit boundaries are in many cases different and in some cases similar in national and European typologies. For example in Belgium the unit boundaries of the main landscape types based on the main soil types are approximately the same. Other units can be very different due to other data sources and other methods that are used. However, it should be noted that the data sources (FAO, ESDB) have been approved by the responsible national experts.

The applied method determines also the landscape typology. Some national approaches are based only on the scientific expertise. Others are the result of a combination of spatial analysis, GIS and visual interpretation or field work.

Concerning the source data (5e) and the applied aggregation (5f) two additional detailed questions have been asked.

Question 5e:
When critically comparing the quality of the source data in the European results with your national classification, which type of problem do you encounter?

No problems.
Minor problems, can be solved with some targeted GIS-surgery.
Moderate problems, will require some reclassifications.
Major problems, will require substantial corrections.
Unsolvable problems.

Answer	ALTERRA	CAU	IECB	IMAR	INB	INRA	LAI	NERI	NIJOS	UAM	UFZ	UNOT	UWH	WSL	ZALF	Σ
None							-								-	0
Minor		•					-					•		•	-	3
Moderate	•		•	•		-	•			•				-	5	
Major			•			•	-		•	•		•	•		-	6
Unsolvable							-					•			-	1

In dependence on the specific national situation the answers of this question vary. There is no partner without problems. The majority of partners encounter moderate or major problems, for only one partner, the University of Nottingham, some problems appear unsolvable. The reasons given for this evaluation are from partner to partner different. Based on the comparison between the national and the European classification they refer to some problems which have to be mentioned and solved. Some examples should be given.

In France the bedrock in Normandy does not reflect the actual conditions and the south west part does not have a Mediterranean climate. By means of geological maps this problem could be solved.

Some climatically very similar regions belong to different environmental zones in the Czech Republic. It is necessary to correct the delineation on the map.

In Denmark both the unit boundaries and the attributes of landscapes are in some cases wrong and have to be corrected.

A correction of the topography layer is needed for Hungary. The climate has to be reconsidered as well. There are significant differences in the western and eastern part of the country (e.g. precipitation from 300–400 to 800–9,000 mm/year). Anatolien climate does not reach towards the middle of Hungary. Therefore the climate and the parent material should be examined. The reclassification afterwards is likely to provide a better typology. National experts should be integrated to reconsider all the basic datasets. With regard to the topography the lowland threshold should be at 150 m–200 m. A further criterion for lowland is no slopes above 5%. Hills should comprise slopes.

Belgium recommends a reclassification of parent material and land use including land use pattern. The climatic conditions do not give a difference to the actual landscape types. The altitude of 500 m–700 m (= highest region in Belgium) are indicated as “mountains”, but is in fact a plateau. Some landscape types are dominated by the attribute “forest” while it is not that dominant land use in the Corine Land Cover map and in the satellite imagery. The integration of alluvium in the parent material would give a clear distinction between some units that are now all grouped in landscape type Als_al. An extent of the database of the European landscape map with more attributes derived from the basic source data would make it more useful.

United Kingdom proposes to experiment with changing resolutions and classification criteria to make the units match the familiar ones in the country.

The land cover source data must be improved for Norway where better data are available. All themes have strange aspects, e.g. the boreal zones and the arctic zone in the north and the area of rock parent material are smaller than expected. It is unclear how many of the problems are due to the source data and how many are a result of generalisation.

Question 5f:
When critically comparing the method/aggregation of data in the European results with your national information, which type of problem do you encounter?

No problems.
Minor problems, can be solved with some targeted GIS-surgery.
Moderate problems, will require some reclassifications.
Major problems, will require substantial corrections.
Unsolvable problems.

Answer	ALTERRA	CAU	IECB	IMAR	INB	INRA*	LAI*	NERI*	NIJOS	UAM	UFZ	UNOT	UWH	WSL	ZALF	Σ
None						-	-					-				0
Minor		•				-	-					-				1
Moderate						-	-	•			•	-		•	•	4
Major	•		•		•	-	-		•	•		-	•			6
Unsolvable						-	-					-				

*** No national typologies exist for Ireland, France and Denmark.**

Concerning the answer of Question 5f there is no partner without problems or with unsolvable problems. The majority of partners encounter moderate or major problems as a consequence of comparing the level of aggregation/presentation of data between their national and the European data. Some examples should be given.

From the Norwegian point of view the level of generalisation seems to mask actual landscape characteristics. Some small polygons are identified as unique types. Maybe some mixed classes must be allowed that could capture units with very much variation, e.g. from sea level to mountain-top within short distances.

In Germany the Corine Land Cover data contains shortcomings concerning the classification of pasture and arable land which have to be removed.

In Belgium sub-divisions of landscape types with arable land based on soil characteristics are needed. The landscape types indicated as artificial surfaces have to be reclassified because they are wrong.

Hungary has the opinion that the aggregation of data should be reconsidered, after a correction of basic data. Expert judgement is needed for setting criteria.

From the Swiss point of view the altitude alone might not be an appropriate surrogate for topography. The roughness of the terrain should also be considered.

The Czech Republic recommends that more detailed and correct information on land cover, especially the forest cover, should be included to discover existing differences between landscape types.

For Portugal it is difficult to answer this question because the methodological approach is different. There is no typology in the Portuguese classification and thus the type of results is rather different.

Question 6:
Do the identified European landscape types in general reflect your national situation? Give some examples please.

Answer	ALTERRA	CAU	IECB	IMAR	INB	INRA	LAI*	NERI	NIJOS	UAM	UFZ	UNOT	UWH	WSL	ZALF	Σ
Yes	•	•					-				•			•	•	5
No							-	•	•				•			3
Partly		•	•	•	•	•	-			•		•				7

*** No national classification for Ireland exists.**

This result is unsurprising because it demonstrates some aspects mentioned above in the comments of Question 5.

The Netherlands, Switzerland, the Czech Republic and Germany have the opinion that in general the major landscape regions and types are well represented on the European map. But in detail there are some differences concerning the delineation of units or the landscape types. For example in the Czech Republic problems have been recognised especially for mountains and hilly areas. Comparing mountain regions in the north eastern and south western (the Bohemian Forest) part of the country similar mountain regions belong to different environmental zones (continental and alpine). But the alpine zone is not a suitable characteristic for the Czech highland. There is a good agreement of the Swiss region, especially with the mountain part and the hills of the Jura mountains.

The Czech Republic (as already mentioned above), Austria, Belgium, France, Portugal, Spain, and UK opine that LANMAP2 reflects only partly the national situation. For Belgium the urban regions are too much expended, in particular for the larger cities in Flanders because the entire suburban zones are included in the urban core areas. It gives the wrong impression as if the northern part of the country is almost completely urban. Some of the delineated landscape units indicated on LANMAP2 have no differentiation in characteristics, although the landscape types are different. For Portugal it reflects some main basic types of landscape support (biophysical) but not the landscape types. For being more accurate the indicators used should have been combined also with some indicators on climate/water availability. Some areas under the same type are rather different from each other and their inclusion in a specific type is rather problematic – the generalisation that has been undertaken is rather rough (for example the Douro valley under shrub or most of the Alentejo under forest or under arable land – there should be a land use type for vineyards and one for silvo-pastoral systems). For the United Kingdom the European scale does not capture the national classification. Some examples should be mentioned. Dartmoor and the Pennines do not really stand out as upland in England because the 500 m boundary is too high. The structure of the Weald (an area south of London to the coast) does not stand out in that the north and the south downs are not differentiated. Furthermore the upland block in the centre of Wales does not stand out.

For Denmark, Norway and Hungary LANMAP2 does not reflect the national landscape situation. In Norway the generalisation has lead to classification of the Lofoten islands as lowland/hills, when in fact the flat lowland shoreline is backed by dramatic 100-m peaks. The

wetlands are missing. In Hungary the main constitution and structure of landscape types is different even though the Hungarian national typology is based on the same attributes like the LANMAP2. The climate divisions used in LANMAP2 do not reflect the Danish climatic situation very much. In Denmark landscape work the influence of climate is not seen as strong compared to the influence of parent material as it is in LANMAP2. In the European map the influence of climate overrides that of parent material too much with the result that the main north–south geomorphologic divide down Jutland is not seen. There are also shortcomings in the typology concerning the parent material, topography and land cover.

Concerning the source data (7e) and the applied aggregation (7f) two additional detailed questions have been asked.

4.5.3 Specific assessment and suggestions

Question 7:
Please specify the location of at least two regional characteristics/attributes for selected landscape units in your country that should be identified and inventoried in a European map. Please provide five examples for each attribute.

There are only a few answers on this question. Maybe the question was not clear enough or more detailed studies have to be made in a next working step.

In the Czech Republic the following three regional characteristics should be inventorised in a European map:

- the harmonious traditional cultural landscape with dominated fishponds in South Bohemia Trebon Basin and Ceske Budejovice Basin;
- the volcanic landscape on north-west Bohemia with typical volcanic, many fruit orchards and vineyards on slopes (specific landscape character, individual landscape unit and landscape protected area Ceske Stredohori Mountains); and
- the vineyards in South Moravia representing a specific landscape character and ethnographic region.

For Ireland forest and woodland, bogs and thatched houses are such regional characteristics which would be an important element in the European map.

From the Swiss point of view the insubrian regions of northern Italy and southern Switzerland, the intra-alpine xeric valleys with steppe-like climate and vegetation in Switzerland and Austria and the glacier areas in France, Switzerland (UNESCO World heritage) and Austria should be reflected on a European scale.

For France one regional characteristic are the hedgerows in the Normandy, Brittany, North-Eastern France and in the areas in the Massif Central. Furthermore the riverine landscapes are a second regional characteristic because they are important both visually and ecologically.

For Hungary some regions of the UNESCO World Heritage like the Fertö-Neusiedler See, the Tokaj vine region, Hortobágy puszta, and the Hollókö village and encircled landscape should be identified in a European map. Moreover the Mountain Meckek, Pecs City and the Balaton Upland with its ancient viticultural traditions are mentioned.

For Austria the actual fine-grain landscape structures, the vernacular architecture (farmsteads, barns, haystacks, field crosses, …) and persistent landscape elements and historical field patterns represent the regional characteristics, for example the region “Waldviertel” – a small-scale upland agriculture with small strip field. Another important regions are the “Wachau” characterised by steep slopes with terraced viticulture and orthogonal network of grassland and hedgerow banks, and the “Salzkammergut” with meadow landscapes in lake basins and glacially shaped hillsides.

Question 8:
Please specify – if necessary – where (minor) cartographic changes or manipulations can correct false results in the European map (e.g. closing of opening polygons to connect or separate areas that are considered to be the same or distinct).

Some partners answer that at the present state cartographic changes needed are major rather than minor. At first it would be more useful to play with the criteria and to reconstruct the map content and the delineation of units. Besides the basic datasets have to be discussed more intensively. Afterwards it will make sense to discuss the cartographic changes in detail.

The Netherlands, Belgium and UK give some examples to change the delineation of polygons of certain landscape types.

Question 9:
Is it necessary to integrate more interactive (expert) knowledge/interpretation into the landscape classification and typology?

Answer	ALTERRA	CAU	IECB	IMAR	INB	INRA	LAI	NERI	NIJOS	UAM	UFZ	UNOT	UWH	WSL	ZALF	Σ
Yes				•	•	•				•	•	•	•		•	8
No	•						•	•	•					•		5
Partly	•	•	•													3

For the majority of partners it is necessary to integrate more interactive knowledge into the European landscape classification and typology. Five partners contest this point of view, while three partners would integrate partly expert knowledge. Those supporting an integration of expert knowledge argue as follows: At the present state of the map it is necessary to include expert knowledge to get good descriptions of what the landscape types really mean. Descriptions of categories – in coded and also verbal form – are important to improve the map and to make it more useful. Expert knowledge is obviously needed to evaluate and to improve the quality of input data. Furthermore it could help in the procedure of classification and aggregation of input data. The formal method has the great advantage that the results are reproducible and therefore the map can be repeated,

and estimations of changes can be made. But a flexible system is needed to build typologies for specific purposes. The flexibility of this approach is the exciting thing about this map and it is the thing that makes it distinctive. The expert knowledge could be useful for setting the criteria of topography and for checking the results, for data aggregation before doing the final typology.

Those partners refusing an integration of more interactive expert knowledge recommend checking the quality of datasets used so that the landscape types may be further refined as the quality of information improves and the associated descriptions should be carefully worded to keep the "common" language. Furthermore additional data could be incorporated. For creating a landscape map with a mainly use on a European level more interactive input is not necessarily as useful as the more automated, analytical approach used so far.

4.5.4 Discussion

In contrast to the very different national classifications and typologies with the LANMAP2 a landscape typology and map was created covering whole Europe for the first time, using state-of-the-art data sets at the European level. The applied European-wide available datasets and the GIS-based methodology represent a great advantage towards the development of a common landscape typology and map on the European level. The map gives an overview of European landscapes and provides a background and common language for monitoring landscape trends at the European level. But in the present form it is only partly accepted by the majority of partners and needs to be improved. There are several aspects which have to be in the focus of further developments. The four input criteria parent material, topography, land cover, and climate are definitely important landscape characteristics for a landscape typology on the European level. But their accuracy and details, e.g. the created altitude classes, have to be checked and redefined. There is a clear quest for integrating further components into the classification such as soil types, precipitation, and the natural potential vegetation of Europe. Information about landscape history, visual and aesthetic aspects of landscapes, environmental conflict or hazard zones should be potentially integrated. Furthermore economic as well as social characteristics and linear elements are missing.

The cartographic representation of the landscape typology is widely or partly accepted. Concerning possible purposes the LANMAP2 is only useful for investigations on the European level, e.g. for a strategic landscape planning, landscape protection, biodiversity and landscape diversity protection. The map provides an overview for European policies, e.g. in the field of rural development, environmental, nature and conservation strategies. The map could be used for the development of landscape and land use change scenarios or hypothesis according to expected global changes and possible political reactions. For national and regional purposes much more detailed information would be necessary.

Hence, it is not surprising that the European landscape types in general do not or only partly reflect the national situation. This appraisal is due to differences between the European classification and national approaches mainly caused by the distinct scales, the used criteria and the location/boundaries of units. When critically comparing the source data quality and its aggregation in the European and the national classification most of the partners encounter moderate or major problems. Besides an integration of more interactive (expert) knowledge into the European landscape classification and typology is necessary to improve it.

4.6 Conclusions

Landscapes underlie a permanent change mainly caused by human activities. In order to achieve a sustainable landscape development and to preserve diverse landscape types updated and detailed information about the state and the changes of landscapes are needed at the regional, national and international level. Based on the analysis presented in this chapter, the following conclusions can be drawn:

1. As expected the analysis of national landscape classifications/typologies has shown the partly great distinctions between European countries. Different input parameter, methodologies and spatial resolutions are the cause for the diversity of national landscape classifications.
2. In view of these distinctions it appears impossible to adjust and to unify the existing national landscape classifications.
3. Furthermore not all countries have a national landscape classification at their disposal.
4. Therefore there is a great need of an agreed-upon European-wide landscape classification/typology to overcome the incoherence especially in transfrontier landscapes and to fill the gap of missing national classifications.
5. With the development of LANMAP2 a first important step towards such an agreed-upon European-wide landscape typology has been done.
6. LANMAP2 represents a new generation of landscape classification and mapping. It demonstrates how traditional methods could be complimented by computer-driven methods. With the availability of new techniques and European-wide datasets new ways can be established for standardising landscape classifications, in order to produce more comparable, more transparent, more reproducible, and to some degree more objective and accurate results.
7. The analysis of the questionnaires about the evaluation of the European classification in comparison with the national classifications shows that in the present form it is only partly accepted by the partners, indicating the need for further improvements.
8. The four input criteria parent material, topography, land cover, and climate are definitely important landscape characteristics for a landscape typology on the European level. But their accuracy and details, e.g. the created altitude classes, have to be checked and possibly redefined.

9. There is a clear quest for integrating further components into the classification such as slope, additional soil types and possibly precipitation. Information about landscape history, visual, cultural and aesthetic aspects of landscapes (e.g. data on linear elements) should be integrated. It also deems useful to link up with information on socio-economic characteristics as well as on environmental conflict or hazard zones.
10. An integration of more interactive (expert) knowledge into the European landscape classification and typology is necessary to improve it.

The European landscape typology and map represents an innovative approach and could be considered as a useful basis for further investigations and discussions towards a European-wide consistent and international accepted landscape classification for scientific and policy purposes.

At the present stage further elaborations and improvements are urgently recommended in order to fully achieve these ambitious objectives. Moreover an integration of the other European countries into a following project is deemed both necessary and useful.

5 Building landscape character indicators

Roy Haines-Young and Marion Potschin

5.1 Introduction

The objective of this part of the project was to examine possible methodological approaches for selecting landscape character indicators as part of a wider European concept. In order to achieve this goal, the work has:

- examined the conceptual basis of landscape indicators and the way they have been developed through recent European initiatives;
- undertaken a survey of recent policy applications that cover a landscape related issues; and
- developed a typology of landscape indicators that can be used as a framework by those concerned with describing landscape and landscape change at the European scales.

In order to provide a basis for the recommendations from this work package, an extensive review of the 'state-of the art' in relation to the use of landscape indicators in a policy context has been made. The review seeks to look at landscape indicators in the context of the general environmental, social and economic indicators that are currently being used, and to identify the key issues that must be considered as we look towards developing a core set of indicators that can be applied at European scales. The literature review was underpinned by the results of a questionnaire survey of ELCAI participants (see Annex IV for details). They were asked to report back on the current situation in their country or region, and to reflect on the appropriateness of the various conceptual approaches to indicator design.

5.2 Landscape indicators and policy: the state of the art

A review of recent literature relating to the development and application of landscape indicators suggests that there is considerable diversity both in the way landscape is conceptualised and represented in terms of an indicator or set of indicators. This review demonstrated that there is – quite naturally – a close link with the types of factors which determine LCA typologies and mappings as identified in Chapter 3:

- the physical form and functioning of the landscape (the 'biophysical');
- the human influence on the landscape form (the 'cultural');
- the human experience of the landscape (the 'perceptual and aesthetic'); and
- the opinions and expressions of stakeholders.

In essence, these factors can be divided into two main categories, namely the 'object'-driven typologies and the 'perception'-driven ones.

5.2.1 Landscape as an object

At one extreme, some studies represent landscape more as an 'object', that is in terms of the physical arrangements of various types of feature. Thus in the landscape ecological literature 'landscape' is often defined in terms of the structure and pattern of a land cover mosaic and its relationships with physical and biotic elements such as terrain, geology, soils and vegetation, and cultural factors associated with people's use and management of the land over time. Landscapes are represented as a heterogeneous area over which the patterns of association of the various elements exhibit a repeated and consistent pattern.

Examples of more 'object' based approaches are provided by policy focused applications such as EnRisk (Delbaere 2005), which has proposed several measures that can be used to identify risk zones for European landscapes. The landscape indicators proposed include:

- landscape diversity;
- landscape coherence; and
- landscape openness and closedness.

Each can be calculated by making a spatial analysis of the patterns exhibited by the various components of land cover across an area of interest. Elsewhere, other types of structural measures have been used to look at change in the fragmentation of open space on an annual basis in Belgium, and change in specific cover types, such as forest.

5.2.2 Landscapes and perception

In addition to the 'object' based approaches described above, other commentators argue that while landscapes have distinct structures, the representation of landscape also depends fundamentally upon understanding the perceptions of people. For example, 'Landscape' according to the European Landscape Convention means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. Such definitions take the notion of landscape beyond that of something that can be described 'objectively' in terms of physical structures, for once we extend the idea to include the perceptions of people, we have to confront the fact that different people or groups may perceive the same landscape in different ways, and that even for a single person or group, perceptions may change over time. If 'landscape' is defined as 'what is in the eye of the beholder', then we enter the realm of more subjective, value-based judgements which are often more difficult to measure.

Many examples can be found to illustrate how perceptual or value-based aspects of landscape have been used to develop indicators. In the Netherlands, for example,

Hoogeveen *et al*. (2000) has reported on the outputs of the MKGR Project, which has sought to monitor the quality of the green environment. The study which reported indicators at the municipality scale, included measure of 'landscape experience'. Elsewhere, in the UK, the Countryside Agency (Countryside Agency 2005) have published the results of a recent study that has developed a new approach to mapping tranquillity in different landscapes, based on participatory appraisal techniques. This work is of particular interest because it represents a move away from the more structurally based approaches to tranquillity mapping, based on the proximity to different sources of potential disturbance, that have been criticised by a number of workers (e.g. CAG Consultants, 1998), to an analysis of based more directly on people's views about the countryside.

5.2.3 Indicator typologies

The object- and perception-based approaches described above should not be thought of as alternative and opposing approaches to indicator construction, but rather as complementary ones. Each seeks to capture a different aspect of what is universally acknowledged as being a complex idea – namely that of landscape. Faced with the diversity of approaches that exist, many have therefore sought to develop general frameworks to typologies of indicators that describe the different type of measure that can be developed.

The most widely used indicator framework is the so-called 'DPSIR' model initially proposed by OECD, which seeks to characterise indicators according to whether they are used to characterise the dynamics of some 'driver', 'pressure', 'state', ' impact' or 'response' variable (Table 5.1). Examples of indictors based on this framework are illustrated by two of the measures proposed by the European Environment Agency's as part of the IRENA Project.

As its name suggests, the IRENA 'landscape state indicator' is a state indicator according to the DPSIR model, based on the landscape parameters of parcel size, linear features and crop variation. It is intended that it should be used to help people understand the differences in structure of the agricultural landscape across Europe and how, potentially they change over time. In contrast the proposed 'landscape diversity indicator' is intended as a tool for measuring the impact of agricultural land use change on landscape, according to the changes in the variety of land use in a given area. In both cases it is proposed that the indicators should be calculated for area-specific, biogeographic and agro-cultural units.

Although the DPSIR model is a useful one for describing different types of indicator according to their place in some supposed chain of causation, it does not easily accommodate the different ways in which landscape is described and used, and other indicator typologies have been proposed. For example, recognition of the importance of the difference between the object- and perception-based approaches to indicator construction led ad hoc working group of the Statistical Office of the European Communities on Landscape Indicators (Eurostat 1998) to suggest that landscape indicators should be categorised on three contrasting levels, namely:

- Level 1: comprising of indicators based on statistical data relating to the occupation of the land (e.g. the proportions of agriculture, forestry, semi-natural or built-up land in an area);
- Level 2: comprising indicators based on patterns and land use/land cover trends (e.g. the degree of fragmentation, diversity, importance of linear features and trends over time); and
- Level 3: comprising indicators that seek evaluate the quality of the landscape and its impact on the perception of the observer.

The conclusions were based on the results of a questionnaire survey to Member States (see Annex IV for details). It was argued that while there was general agreement about the measures that fell within the first two levels, with those in the first being better developed than the second, for the development of indicators at Level 3, something of a 'quantum leap' in methodological development was required. It was argued that it is this level which has to be studied in greater detail in order to develop indicators which allow an objective characterisation of the landscape, taking account of the cultural diversity of the various countries.

A similar conclusion was drawn by the more recent OECD study, reported by Dramstad and Sogge (2003), which suggested a four-fold grouping of landscape indicators for assessing agricultural impacts on landscapes (Table 5.2), namely those relating to landscape structure, function, management and value.

The structural measures identified in the 2003 OECD typology study largely comprise those identified by the first two levels in the Eurostat (1998) document. The new elements of this scheme make more explicit the difference between the structural aspects of landscape and its uses or functions (such as for recreation, biodiversity or agricultural production) or its management (e.g. actions related to various policy objectives). The notion of 'value' envisaged by Dramstad and Sogge (2003) largely corresponds to the indicators at Level 3 of the Eurostat (1998) classification, in that their construction depends on the response of people. However, it is also clear that the OECD scheme takes these perceptual measures beyond elements that seek only to describe the way the landscape is experienced (e.g. in terms of 'tranquillity', 'openness' or 'naturalness') to include a monetary measure of the importance of that landscape to various types of users. As with the earlier study by the SOEC, the 2003 OECD Working Group also

TABLE 5.1. OECD 'DPSIR' Indicator Model.

- **Drivers** e.g. Policy ~ CAP
- **Pressures** e.g. Agricultural change ~ abandonment
- **State** e.g. Characteristic elements ~ woodland cover
- **Impact** e.g. Change in character ~ change in biodiversity
- **Response** e.g. Agri-environmental payments

TABLE 5.2. OECD typology of landscape indicators.

Indicator group	Examples
Structure	Woodland pattern, fragmentation
Function	Recreation, biodiversity
Management	Agri-environmental payments
Value	Willingness to pay

conclude that indicators that seek to describe or measure the value of landscapes are as yet the most poorly developed. Dramstad and Sogge note that while there has been significant advance there is still "…. a skewed distribution in terms of the indicators developed" (Dramstad and Sogge 2003. p.6), with a considerable emphasis on indicators of landscape structure rather than those covering the other aspects of landscape that are important to people.

As in the case of the differences in approach that have been generated by the object- and perception-based approaches to landscape, existence of different indicator typologies should not be viewed in terms of competing and alternative models. Rather the diversity of view reflects more the specific contexts in which different assessments are set. This shows that in many cases, practitioners did not feel it necessary to represent their indicators in terms of any particular typology, or to describe in any depth how 'landscape' as an underlying concept was understood. Moreover, while all of the assessments seek to represent 'landscape', the particular measures selected vary from study to study, and there appears to be little agreement about what might constitute a core set of indicators that capture the fundamental aspect of landscape.

Faced with the situation that there currently appears to be no common approach to the design of landscape indicators across Europe, or any agreement about any set of metrics that definitively can be taken as representing landscape, this ELCAI project has gone on to examine the question of what types of measure might be selected when we are faced with the task of monitoring the landscape implications of a given set of policies. Our results and recommendations can best be described in terms of two key ideas, namely the way in which indicators are referenced spatially or geographically, and the way in which they relate to the more general notion of 'landscape character'.

5.2.4 Landscape indicators as spatially explicit measures

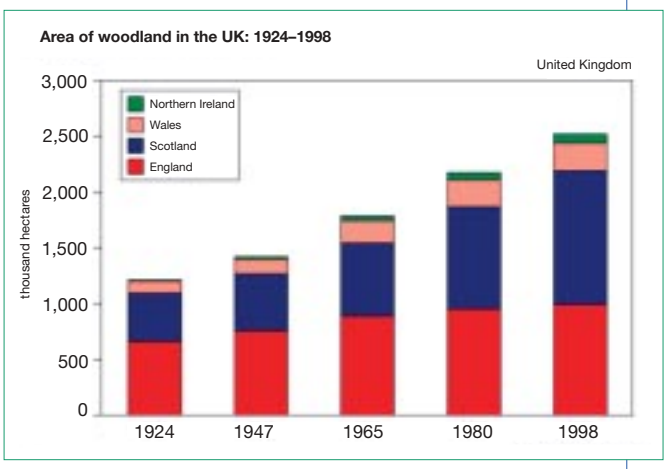
In order to help clarify the issues surrounding the development of landscape indicators, a key question that has been examined in this part of the project is the extent to which such indicators should be spatially explicit; that is the extent to which they refer to a specific set of places or areas. The reason why this question is important is that while the notion of landscape may cover many different types of theme or attribute, ultimately such measures have to be referenced to some locality or set of localities if they are to help us understand the implications of change at the landscape scale. In fact, the property of being spatially explicit seems to capture one of the most important ideas that is embodied in the landscape concept, namely that it is essentially an area in which we can recognise a repeated and consistent pattern between of various landscape elements, that can be used to distinguish these units from all others. This notion applies whether those landscape elements are based on the recognition of 'objects' (e.g. woodland blocks or linear features) or perceptual elements (e.g. tranquillity).

The importance of the link between landscape indicators and some explicit spatial framework can be illustrated by reference to Figure 5.1, which shows the change in woodland cover in the UK between 1924 and1998. The indicator is taken of the suite of indicators of sustainable development, and has been used by UK Government to monitor policies that promote increasing woodland cover (Department of the Environment 2000).

Although woodland is clearly an important landscape element and a general increase in forest cover would have important landscape implications, as it stands the measure shown in Figure 5.1 is best regarded as a general environmental indicator because it does not reference the change to any particular (i.e. explicit) landscape type. Rather, it deals with woodland change in four general administrative regions, each of which contain many different types of landscape. Thus, while such measures are helpful in monitoring policies at one scale, the implications of woodland change in different landscapes cannot easily be judged. We know, for example, that while an increase in woodland would be beneficial in some areas, where cover had been lost as a result of recent land use change, whereas large scale planting in other areas would fundamentally undermine the historical and cultural aspect of these landscapes.

In order to test the proposition that a landscape indicator must be spatially explicit, that is be designed to refer to the conditions of a particular landscape or set of landscapes, a questionnaire survey was undertaken across the members of the ELCAI consortium. The aim was to find out how many of the landscape typologies identified in the Scientific Review (Chapter 3) had been used as a spatial framework for indicator construction,

FIGURE 5.1. Example of an environmental indicator.
(Source: The Forestry Commission)



what other types of spatial framework had been employed in the design of landscape indicators, and what general agreement there was amongst practitioners that a fundamental property of landscape indicators was the way they were referenced to explicit landscape units.

The material presented in Table 5.3 notes the type of landscape measure, its geographical coverage and the spatial framework (i.e. mapping unit) used. The data were derived from the questionnaire material generated by this part of the project (see Annex IV/A) and our wider review of other studies. The insights gained were supplemented by the results of an earlier questionnaire survey made as part of Work Package 1, which asked ELCAI members to identify any indicators that had been linked to the typologies they described, and how they linked to the DPSIR and 2003 OECD typologies (Annex IV/B).

TABLE 5.3. Landscape indicators in European countries and Europewide. (Sources: **bold** = ELCAI Partner questionnaire, otherwise literature review).

Country	Indicator(s)	Coverage[1] and Mapping Unit	Source
Austria	Area and quality Quality of targeted habitats (edge length and density of ecological infrastructure)	Tyrol (for certain landscape types) C (Cultural Landscape Types)	
Belgium	Increase of Built-up Area and fragmentation of open	Flanders Region (?)	Flanders Environment Report
Czech Republic	Defoliation of Forests Natural condition of forest growth Historical Land use Anthropogenic transformation of landscape and its aesthetic value	C C (41 natural forest units) C (cadastral units, district, regions) C (9 basic landscape types)	
Denmark	Land Use types	C (municipalities)	
Finland	Edge density of field margins Change in openness of ls Tourism accommodation Building permits	C (counties)	NINJOS/OECD (2002, 108 ff)
France	Length of planted hedgrows per annum	Brittany (NUTS 3)	
Greece	Land Cover Land Use Land Values	C (administrative units)	NINJOS/OECD (2002, 130 ff)
Hungary	Land use change Growth of forested area	C (Hungary) C (national, regional)	
Ireland	Woodland/Forest area Visual Landscape Impact	C (county) C (viewshed basis)	Indicative Forestry Strategy Draft Wind Energy Guidelines
Netherlands	Landscape heterogeneity and connectivity Change/genesis Landscape Change of landscape type	C C C	
Norway	See Table 5.4, this report	C (counties)	
Portugal	No questionnaire provided		
Spain	No questionnaire provided		
Switzerland	Indicators based on stock and quality of area and linear landscape features	C (cantons)	http://www.umwelt-schweiz.ch/buwal/shop/files/pdf/phpNUNM56.pdf http://www.umwelt-schweiz.ch/buwal/shop/files/pdf/phpXMd08b.pdf
United Kingdom (England)	Landscape character – physiography – land cover – cultural pattern	C (159 character areas for England)	www.countrysidequality counts.org.uk
European Scale	Landscape coherance Openeness/closeness Landscape Diversity Landscape state	European Landscape Classification	EnRisk EnRisk EnRisk/IRENAw IRENA

When respondents were asked as part of the questionnaire survey (Annex IV/A, Question 1) to describe any landscape indicator that had been used on a policy context, a number of examples were identified. Table 5.3 shows, that in terms of the types of spatial unit used to represent them, it was apparent that they range from administrative units (e.g. state, region, municipality or forest district), abstract geometric units (e.g. 1km x 1km grid squares) through to units that are more clearly delimited in terms of their biophysical or socio-cultural characteristics (e.g. 'eco-districts', natural forest areas, or Landscape Character Areas). Although most of them are therefore spatially explicit, they are more like the example shown in Figure 5.1, in that they refer to areas that are unlikely to constitute a single 'landscape' type within which there is some degree of internal homogeneity or unity. Thus interpretation of the implications of change in the indicator for conditions on the ground may be difficult or ambiguous.

When asked to identify which of the indicators had been used in the context of a specific landscape typology (Annex IV/ A, Question 2), many fewer examples were provided. Belgium, Denmark and Germany, for example, reported none, even through the more general question about the use of landscape indicators in a policy context had revealed that for the first two, at least, landscape indicators had been constructed. In both cases the measures appeared to be reference to an explicit spatial framework, but one which was less clearly tied to variations in landscape structure than the other examples identified.

One of the most sophisticated uses of a landscape typology as a spatial framework for constructing a suite of landscape indicators was the '3Q' Project reported from Norway (see Table 5.4, and Annex IV/A). Here a set of landscape formed part of a larger suite of measures designed to establish a baseline that could be used to monitor landscape changes in agricultural landscapes – with the aim to establish whether agro-environmental policies have desired effects (Puschmann *et al*. 2004). The landscape units that provided the spatial context for the indicators were the set ten agricultural landscape

TABLE 5.4. Variables reported from the Norwegian 3Q monitoring programme.

Theme	Subject of interest	Reported variable
Spatial structure - landscape	Land type	Area of each type
	Fragmentation of different land types	Average size of coherent units; Total units per km^2
	Landscape diversity	Shannon's diversity index
	Landscape heterogeneity	Heterogeneity index (HIX)
	Edge types	Length of each type
	Water edges	Length of different types; Area of different land types in 10m-buffer zone
	Buildings	Number per land type; Percent on each land type
Spatial structure - agricultural land	Land type (level III)	Area of each type
	Fragmentation	Number and size of fields
	Diversity of agricultural land types	Shannon's diversity index
	Field shape	Area weighted average shape index
	Field edge types	Length
	Linear elements on agricultural land	Number; Length
	Non-crop islands in agricultural land	Number; Percent of different types
	Point objects in agricultural land	Number; Percent of different types
Biodiversity [a]	Diversity of habitats	Shannon's diversity index
	Abundance of farmland birds	Number of species, numbers of individuals
	Distribution of farmland birds	Percent of sample squares in different regions where selected species are present
	Diversity of vascular plants	Number of species, Shannon's diversity index
	Distribution of vascular plants	Percent of sample squares in different regions where selected species are present
Cultural heritage	Historical buildings	Number
	Cultural heritage features and sites	Number, land use around features of different types, visibility of features
Accessibility	Access routes	Length; Percent of different types
	Connectivity	Gamma-index
	Disturbance from roads and built-up areas	Area within 100 m distance intervals; Percent in each distance interval
	Accessible land	Area accessible for three mobility groups; Percent area accessible to the three mobility group

a The landscape metrics listed under the theme of 'spatial structure' are also used as indicators for the biodiversity theme. Bird and plant indicators were not reported in the county reports since these started as research projects rather than part of the monitoring programme. However, these indicators will be included in future reporting.

regions identified at the national scale, defined in terms of the conditions they impose on farming. These national units were formed by the aggregation of 45 landscape regions, which were themselves based in a set of 444 smaller sub-regions.

In terms of the extent to which landscape indicators are designed to be spatially explicit, it is apparent from our review that they are, although the nature of the spatial referencing system varies from study to study. Given the way in which statistical data are generated it seems inevitable that landscape indicators will continue to be constructed across sets of administrative units rather than 'real' landscape types, and it could be argued that ultimately such measures are valuable, because they have a close link to the management structures through which policies are implemented on the ground. However, to be useful these indicator frameworks must provide some understanding of the sensitivity of landscapes within the unit to change in the indicator variable if these measures are to be informative. The indicators constructed must be sufficiently sensitive or reliable to distinguish one area from another and to track their different trajectories over time. In order to explore how this might be achieved Work Package 5 went on to examine the general concept of landscape character and the potential use of indicators of landscape character.

5.2.5 Landscape indicators and indicators of landscape character

As noted elsewhere in this Report 'landscape character' is defined as a 'distinct and recognisable pattern of elements in the landscape that makes one landscape different from another….' (Swanwick and Land Use Consultants, 2002), while 'characterisation' is simply the process by which we identify and describe areas of similar character, and go on to classify and mapping them. Such ideas have been developed, stimulated as a result of an extensive body of work in the UK in the 1990s that developed in response to efforts two decades earlier, which sought to evaluate landscape.

The goal of landscape evaluation is to identify what makes one landscape 'better' or 'worse' than another. The development of rigorous evaluation techniques had, however, proved contentious in the 1980s and so workers sought to separate out tasks of classification and description from that of evaluation. The aim of landscape classification and description, it was suggested, was to identify what makes one landscape 'different' or 'distinct' from another, which was quite different from that of assigning relative values. As a result of such work, a systematic process of classification and description known as 'Landscape Character Assessment' has been developed (Swanwick and Land Use Consultants, 2002).

As part of the brief for this Work Package, we examined the conceptual basis of landscape indicators in more detail by exploring the question of what more is added to the notion of a landscape indicator by linking it to the idea of landscape character. We have asked: Are indicators of landscape character different, from landscape indicators, and if so what role might they play in wider policy applications?

Our review starts from one of the most basic tenets of the 'landscape' concept, namely that landscapes are normally defined or delimited in terms of set of repeated and consistent pattern of elements. Although the idea of 'landscape character' merely builds on this, the concept takes it further in that we attempt to make it *explicit* what these patterns are from a given perspective. This perspective is usually a socio-cultural one, although increasingly it be becoming recognised that landscape characterisation techniques can be used to provide a range of different 'views' of the landscape. This 'Historic Landscape Character Assessment' is now recognised as a distinct by complementary type of exercise to the more general Landscape Character Assessment. Urban Character Assessment appears to be emerging as another (see Swanwick and Land Use Consultants 2002).

Thus one could argue on the basis of recent developments in the literature, that while a landscape indicator is an environmental indicator that has some explicit reference to a prescribed set of landscape units, an indicator of landscape character is a measure that is not only spatially explicit, but also one that is referenced to some shared but abstract understanding of the perceived patterns that may each landscape unit 'locally distinctive'. Landscape indicators therefore tell us something about how the individual elements or features that define landscape change over space or time. Landscape character indicators are, by contrast, somewhat more holistic, in that they can help us to understand how such changes modify or transform the combined patterns of all the elements of landscape, that given an area its 'sense of place'.

In order to test this proposition, a further question was included in the survey of ELCAI partners, to understand how they viewed the idea of landscape character and its role in indicator construction (Table 5.5, and Annex IV/A, Question 3). In general it was *agreed* that the distinction between the term 'landscape indicator' and 'indicator of landscape character' was a reasonable one to make (Question 3i), although only a few examples could be identified to illustrate the construction of an indicator based on notions of character (Question 3ii). In fact, responses showed that there was considerable *disagreement* about the extent to which any single measure could be used to represent landscape character (Question 3iii). Two national applications, one from the Netherlands[4] (the NLI Project) and other from the UK[5] (Countryside Quality Counts) specifically used ideas about landscape character to explore issues of environmental quality issues. The latter specifically sought to develop an indicator of overall character that could be used at national scales.

4 www.meetnetandschap.nl
5 www.countryside-quality-counts.org.uk

TABLE 5.5. Summary of partner positions on role of landscape character concept in indicator development.

Question	Austria	Belgium	Czech Republic	Denmark (I)	Denmark (II)	Germany (I)	Germany (II)	Hungary	Ireland	Netherlands	Norway	Switzerland	UK
i) Is the distinction between landscape indicators and indicators of landscape characters suggested above one that you would agree with?	Yes(Q)	Yes	–	Yes	Yes	Yes	Yes	Yes(Q)	Yes	Yes(Q)	Yes	Yes	Yes
ii) Given the definition of landscape character outlined above, can you identify any specific examples of the construction and/or use of such an indicator at local, national, regional or European scales?	No	No	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes
iii) Given that landscape character is defined in terms of the perceptions of people, do you feel that there is scope for constructing a map of landscape character as opposed to landscape types the European scale?	Yes(Q)	No	No(Q)	No	No(Q)	No(Q)	Yes(Q)	No	No	No	No	Yes(Q)	Yes
iv) Would such a map have scientific or policy relevance at the European Scale?	No	No	Yes(Q)	Yes	Yes(Q)	Yes(Q)	Yes(Q)	No	Yes(Q)	Yes(Q)	Yes(Q)	Yes	Yes
v) From your experience of using the various landscape typologies reviewed by WP1, do you feel that their application is limited in any way by the fact that the units are unrelated to people's perceptions of what makes or distinguishes a landscape?	No(Q)	No	Yes(Q)	No	Yes(Q)	Yes(Q)	No(Q)	_	Yes(Q)	Yes(Q)	Yes(Q)	Yes(Q)	Yes
vi) From your experience of using the various landscape typologies reviewed by WP1, do you feel that their application is limited in any way by the fact that the units are unrelated to people's perceptions of what makes or distinguishes a landscape?	Yes	Yes	Yes	No	No(Q)	No	Yes	Yes	Yes(Q)	Yes(Q)	No(Q)	Yes	Yes

Q = qualified (in a sense that there were reservations)

From the analysis of the survey results it was clear that for many the question of whether variations in landscape character could be mapped was often conflated by respondents with the issue of whether indicators of change in overall character or important aspects of character could be constructed. While many agreed that mapping could be achieved, fewer though that holistic indicators could be built.

The dilemma between the requirements of mapping and indicator construction is perhaps best illustrated and explained by reference to the Countryside Quality Counts Project in the UK, in which an indicator of change in landscape character was constructed (Haines-Young *et al*. 2004). In this application, the overriding policy issue was to identify where landscape change was occurring at national scales (England) and determine whether these changes mattered. The study used a map of Countryside Character Areas to provide the spatial framework for indicator construction, and their associated descriptions to understand the context in which change in the key elements that defined character could be judged. Thus by looking at how individual elements of landscape, such as woodland, boundary features, agricultural land cover, settlement and development, semi-natural habitats, historic elements and river and coastal features were changing over time, those character areas where the existing character of the countryside was being modified or transformed in a significant way could be identify.

The key message from the UK study for ELCAI, is that the existence of a systematic characterisation of the landscapes provided the contextual information that was required in order to interpret the significance of the changes shown by a given landscape indicator, in terms of what made those specific landscape distinctive from other areas.

Thus despite differences of opinion amongst ELCAI partners, the distinction between landscape indicators and indicators of landscape character appears to be a useful one, because it emphasises the importance of understanding the landscape context in which the significance of changes in an indicator can be judged. Landscape characterisation is an important adjunct to the development of landscape indicators because it provides an assessment framework within which the implications of change at the landscape level can be judged. In other words it allows us to meet the challenge

set down by the Eurostat (1998) to develop indicators at their 'level 3', namely to attempt 'an objective characterisation of the landscape, taking account of the cultural diversity of the various countries'.

The importance of developing the kinds of contextual understanding that landscape characterisation provides was in fact recognised in the survey of ELCAI partners. As summary Table 5.5 shows (see also Annex IV/A, Question 3), most felt that, despite some qualifications, a mapping of landscape character at European scales would have policy relevance. For example, the respondent from Belgium argued that a map of landscape character at European scales would 'highlight the huge variety of landscapes throughout Europe'. In addition, it was also suggested that it would 'serve as a spatial reference for region specific policies (CAP and rural development)' and help us understand 'regional 'identity' as the starting base for sustainable development'. The response from the Netherlands argued that a 'landscape character map can be used to combine region specific scientific thresholds (e.g. environmental) and policy targets.'

When asked (Table 5.5, question iv, and see also Annex IV/A) if the development of indicators of landscape character would help to overcome some of the problems associated with the use of the more bio-physically based landscape typologies identified in Work Package 1 the majority of ELCAI respondents felt that they could be helpful, although fewer thought it could be done at European scales. The exploratory study of Hunziker and Kienast (1999) has shown, however, that pattern indices derived from the analysis of photographs can be used as a tool for mapping people's assessment of natural beauty in a test region in Central Europe – thus some rapid assessment might be possible.

5.3. Landscape indicators and indicators of landscape character at European scales: prospects and recommendations

This Work Package has examined the conceptual basis of landscape indicators and their recent development in Europe through an analysis of the 'state of the art' based on a literature review and a survey of ELCAI partners. Two broad conclusions can be drawn from this work that provide the basis for our recommendations about how landscape indicators and indicators of landscape character and be used as policy tools at the European scale.

The first conclusion that can be drawn from this part of the project is that although there is a considerable diversity of approach, landscape indicators can be developed at local, national, regional and continental scales that have policy relevance. These measures can properly be described as 'landscape indicators' because that they can be linked to spatial frameworks that give them meaning in terms of the way they describe the biophysical and socio-economic pattern and process that distinguish one place from another. For future work, we therefore recommend that when policy applications require that the landscape dimension is included, the design of the indicator is based on consideration of *two* factors, namely:

i) *what aspect of landscape is to be assessed*, that is does it relate to the structural, functional, management or value aspects of landscape, or does it describe the drivers or pressures of landscape change, states, impacts or policy responses; and
ii) *what relationships exist between the indicator and the spatial framework across which variations over time and space are assessed?* These spatial units should have some explicit relevance to landscapes in that they should allow us to understand how the indicator relates to the distinctive properties of specific and prescribed areas at whatever scale is relevant to the policy question at hand.

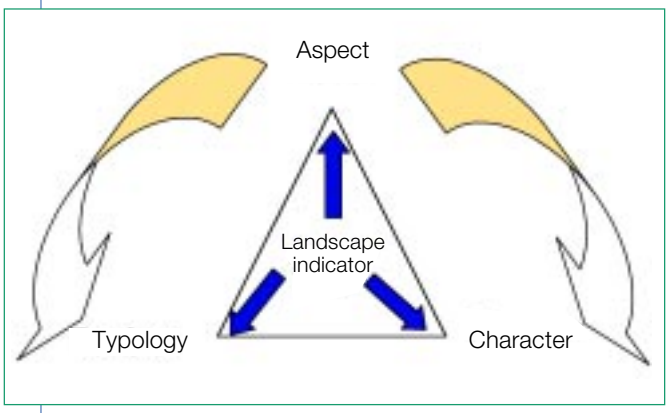
Based on the analysis of current approaches, the most informative type of landscape indicator are therefore those which are *spatially explicit*, in that they inform us about the properties of landscape units that have some biophysical and/or socio-economic integrity. *Thus the link between the indicators discussed here and the various landscape typologies reviewed in the Scientific Review (Chapter 3) is an important and fundamental one.* Our survey has shown that although some progress has been made in using these typologies as frameworks for indicator construction, much more can be done to exploit what these classifications can tell us about landscape, and to provide a *context* in which the changes depicted by our landscape indicators can be understood.

The second key conclusion that emerges from this study concerns the need to establish the contextual framework in which landscape indicators are interpreted. Our work has shown that although there are different interpretations of the concept of landscape character, there is general agreement amongst practitioners that holistic understandings of what makes one landscape distinct from another, and which gives these landscape their 'sense of place', are useful. Thus the link between indicator construction and Landscape Character Assessment emerges as a second consideration that when policy applications require that the landscape is taken into account. Figure 5.2 therefore summarises the fundamental conceptual dependencies that emerge in the construction of landscape indicators.

In this study we have found that although some have attempted to construct indicators of landscape character that seek to capture the more holistic properties of landscape, conceptual frameworks are not sufficiently well developed at present to attempt this at European scales. However, considerable progress could be made if existing landscape classifications and typologies at European scales could be augmented through a process of character assessment so that the properties of the spatial units used to represent the indicators are better understood. Landscape characterisation could provide a systematic approach to the construction of the contextual framework in which landscape indicators gain meaning 'on the ground'.

Given the current 'state of the art', a feasible approach to the construction of landscape indicators at the

FIGURE 5.2. Dependencies between landscape metrics, landscape typologies and Landscape Character Assessment.



European scale can be identified by reference to the final set of survey results collected as part of this work package.

ELCAI partners were asked (Annex IV/A, Question 4) to review the rationale for the three landscape ENRISK indicators (openness, coherence and diversity) and two IRENA indicators (state and diversity), together with the practicalities of developing them the European scales, and in particular the opportunity offered by the spatial framework of the European Landscape Classification (LANMAP2, see Work Package 4 for full description).

Respondents generally felt (Table 5.6) that as landscape indicators at the European scale, the rationale for the ENRISK indicators was more secure than those of IRENA, and that, despite some qualifications, it was feasible to develop such measures at European scales, given the availability of CORINE land cover change data. Linking these finding with those of the other sections of the survey it is clear that while such an exercise is technically feasible interpretation of the significance of change in the ENRISK indicators by the spatial units of LANMAP2, would be difficult, unless the latter were supplemented by some kind of broad character assessment that described what coherence, openness and diversity mean for each of the major landscape types. For example, the respondent from Switzerland argued that while the 'coherence' indicator was a useful one, it would be problematic to use in the absence of a sophisticated perception study that helped us understand what is mean by 'natural'.

The landscape classification represented by LANMAP2 is presently based on four parameters, namely climate, topography, parent material and land cover. Work Package 4 concludes that it would be valuable to extend the range of parameters used to include soil types, precipitation and the natural potential vegetation. The implication of this result is that in the medium term the typology will remain essentially one based on biophysical parameters. In the absence of a stronger cultural component, it is therefore unclear to what extent such typologies are able to fully represent real landscapes if we view them in terms of the European Convention as areas '… perceived by people, whose character is the result of the action and interaction of natural and/or human factors'. *The development of a more explicit cultural dimension to these typologies is, we recommend, a high priority for future work.*

A focus on biophysical parameters as the basis for constructing pan-European landscape typologies is inevitable, given the range of data that are available at these scales. These typologies can still be used as a framework for indicator construction and interpretation, however, if Landscape Character Assessment techniques are used to describe more fully the features that make them distinctive and therefore the context in which a particular set of landscape indicators must be viewed. Recent work, such as the study on *European Transfrontier Landscapes* (Wascher and Pérez-Soba, 2004), illustrates how that this can be done.

The *Transfrontier Landscapes* study was selective in that it identified a set of case study areas through which the

TABLE 5.6. Review of ENRISK and IRENA indicators made by ELCAI partners. Q = qualified (in a sense that there were reservations)

	Enrisk 1 (coherence)		Enrisk 2 (openness)		Enrisk 3 (diversity)		IRENA 32 (state)		IRENA 35 (diversity)	
Country	rationale	feasability	rationale	feasability	rationale	feasability	rationale	feasability	rationale	feasability
Austria	Yes (Q)	Yes (Q)	Yes	Yes	Yes (Q)	Yes	Yes	Yes	Yes (Q)	Yes
Belgium	Yes		Yes (Q)	Yes (Q)	Yes (Q)	Yes (Q)	No		Yes	
Czech Republic	Yes (Q)	Yes	Yes	Yes (Q)	Yes	No (Q)				
Denmark (I)										
Denmark (II)										
Germany (I)	No	No	Yes	Yes	Yes	No	Yes	No	Yes	No
Germany (II)	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	No
Hungary	Yes (Q)	No	Yes	Yes	Yes (Q)	Yes	No (Q)	Yes	Yes	No
Ireland	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Netherlands	Yes	Yes	Yes	Yes	Yes	Yes				
Norway										
Switzerland	Yes	Yes	Yes	Yes	Yes	Yes	Yes (Q)	Yes	Yes	Yes
UK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No

particular issues affecting transfrontier landscape could be considered. The work was nevertheless general, in the sense that the delimitation of these areas was based on the pan-European classification of LANMAP2. The information contained in this map was however, enriched by developing for the case study areas, a rich body of landscape contextual information that enabled their individual and distinctive characters to the understood. Through such characterisations one could begin to develop an understanding about where issues related to changes in, say, openness or coherence, might be significant, and thus develop the kind of framework in which more general landscape indicators could be designed.

Thus, in order to take forward the process of developing landscape indicators at European scales we recommend that existing biophysical typologies, such as LANMAP2, are used as a framework for making a European Landscape Character Assessment. The character assessment should focus on specific landscape parameters that are presently measurable at these scales (e.g. openness, coherence etc.) and describe how these parameters relate to what gives these units their local or regional distinctiveness. The assessment should specify, for example, where openness is an important property of landscapes, and where its loss would be detrimental to character, or where changes in landscape diversity would undermine traditional land use patterns.

5.4 Conclusions

This study has shown that in conceptual terms, landscape indicators can be thought of as distinct types of metric, providing they are referenced to a spatial framework that maps tracts of land that share a set of common set of structural or functional characteristics. Thus decisions about what landscape parameter to identify as an indicator and the spatial framework over which it is to be mapped are fundamentally linked. Our study has also shown that it is now possible to construct simple indicators that capture properties such as openness and diversity at pan-European scales, and to represent them spatially through Europe-wide landscape classifications, such as LANMAP2. However, our work also suggests that the application of such indicators as policy tools can be increased if these typologies were enhanced by making a character assessment of the major landscape types that they identify. Such character assessments provide the contextual information in which indicator trajectories can be interpreted.

6 Landscape character in the context of policy and stakeholder interests

Geert de Blust, Tatiana Damarad, Ana Nieto and Ben Delbaere

6.1 Introduction

During the last years, the increasing significance of landscapes as a policy issue at the European level resulted in more information needs on the geographic distribution and typology of these landscapes. Policy implementation requires knowledge about the exact location, extension and characteristics of landscapes that receive policy interest. Despite a number of encouraging research activities in the field of landscape ecology and geography, there is still a lack of widely recognised landscape typology and mapping that can find applications in the policy field. While a number of useful landscape typologies and maps have been developed at the national level, European approaches towards landscape mapping are still facing severe problems in terms of scale, accuracy and policy relevance. Policy relevance depends on the degree of how much the level of scale corresponds with the level of actual decision-making. For general assessments it might suffice to operate at the level of landscape regions while more specific question of policy implementation at the national and regional level might require differentiating between landscape types or units.

The objectives of the work packages on policy and stakeholders were "*to identify focal points (other sectoral experts, decision-makers) and involve stakeholders at the regional/national level who can inform about the decision-making process of land use, landscape planning, regional and spatial development, and zoning affecting the landscape*". Besides, it was foreseen to "*seek contact to national and international representatives of the 'Europe of the Regions' initiative*".

Involvement of stakeholders means exchange of information, co-operation, discussions all through the course of the project. It assumes a mutual benefit, for the project and the stakeholders. Ideally, clear statements about expectations and about the type and extent of the involvement should be made at the start of any co-operation. This prevents disappointments and misunderstanding afterwards.

From the ELCAI context it follows that a variety of potential stakeholders can be identified. On the one hand there are the different policy domains and levels which relate directly or indirectly to landscape issues, on the other hand there are the different players that are active in these fields.

It should be clear that we cannot involve all potential stakeholders in ELCAI. Therefore project partners have had to select carefully for the most appropriate. To do this efficiently, the role and position of stakeholders has had to be elucidated.

From the overall project objectives, '… *reviewing the existing scientific, strategic and policy context in the field of landscape assessment* …" follows that stakeholders should inform us about how Landscape Character Assessment is actually used and implemented in different

FIGURE 6.1. Stakeholder Scheme.

		Policy domain					
		Regional development	Physical planning	Land use	Landscape policy	Nature conservation	Sectoral resource planning (agriculture, tourism, mining ..)
Actors:	Public authority NGO Private sector (interest groups)						

Policy level		
international	national	regional
World e.g. UNESCO Europe e.g. "the Regions"		Geographical region Institutional region Federal state

FIGURE 6.2. Stakeholder Scheme 2.

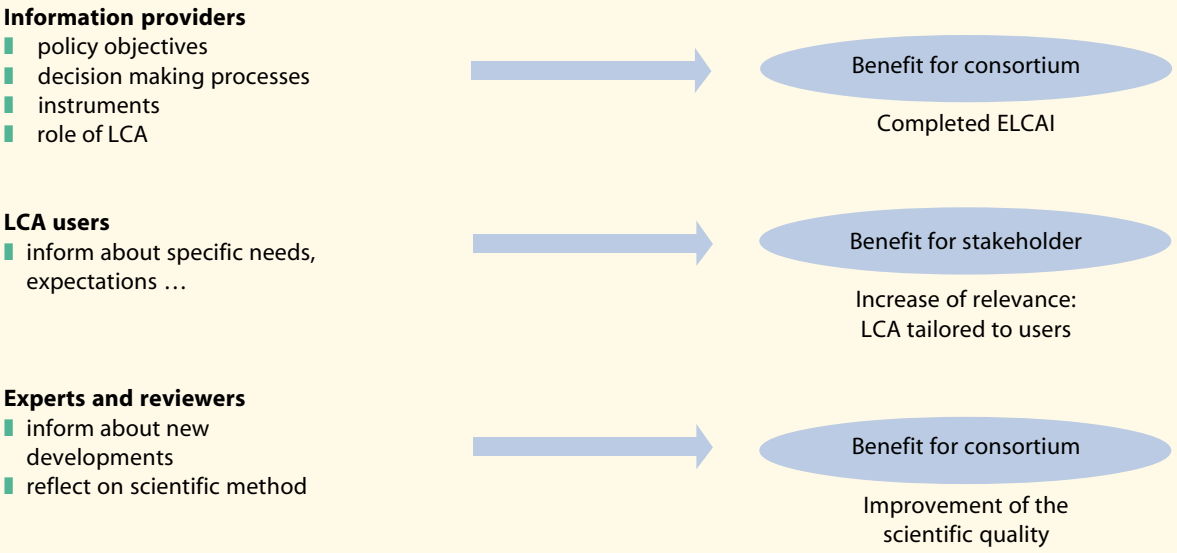


TABLE 6.1. Stakeholder participants at the Utrecht kick-off meeting.

Name	Organisation/website	Place/ Country	Domain of interest
Joël Rochard	ITV http://www.itvfrance.com/	Epernay / F	Sustainable viniculture
Laurence Stevez	ITV http://www.itvfrance.com/	Epernay / F	Sustainable viniculture
Cathy Buchanan	Landscape Alliance, Ireland http://www.landscape-forum-ireland.com/landscape-alliance-ireland.html	Cork / IE	Landscape policy
Terry O'Regan	Landscape Alliance Ireland http://www.landscape-forum-ireland.com/landscape-alliance-ireland.html	Waterfall, Near Cork City / IE	Landscape policy
Riet Dumont	Province Gelderland, Landelijk gebied http://www.gelderland.nl/	Arnhem / NL	Regional policy
Colette Bosley	Monmouthshire County Council Planning and Economic Dev. Dept. http://www.monmouthshire.gov.uk	Cwmbran / UK	Regional policy
Ruth Benson	Wrexham County http://www.wrexham.gov.uk/	Wrexham / UK	Regional policy
David Eager	Countryside Council for Wales http://www.ccw.gov.uk/	Bangor / UK	Landscape and wildlife conservation

countries and for different purposes. This will yield a picture of everyday practice that then should be compared with 'ideal' applications and methodologies.

The role of stakeholders can also be defined more specific, related to their contribution to the project and their benefit from the project. Then, the following categories, as shown in Figure 6.2, can be distinguished.

Stakeholders expressed their views about Landscape Character Assessment and ELCAI by plenary presentations and in small discussions groups. The variety of opinions, expectations and experiences was obvious. The stakeholders who attended the Utrecht meeting, their organisations and interests are listed in Table 6.1.

The policy review questionnaire was structured in such a way that it was rather easy to identify policy sectors that have an active interest in or are actually applying Landscape Character Assessment. However, linking these policy domains with particular persons or organisations was seldom possible. Because the questionnaire was meant to cover the national or regional (in case of federal states) level, this is not a big problem, as establishing stakeholder contacts on that level is seen as the responsibility of the individual ELCAI partners. The policy sectors that were most often cited as having a clear interest in Landscape Character Assessment, and hence can become important stakeholders for project partners, are given in Table 6.2.

TABLE 6.2. Policy sectors that show an interest in Landscape Character Assessment.

Policy sector	Countries and regions that show interest
Landscape policy, cultural heritage	AT, CH, DE, DK, FL, HU, NO, PT
Spatial and rural development	AT, CH, DK, FL, HU, IE, NL, NO
Agriculture	AT, DE, DK, FL, HU, NL, NO
Forestry	CH, DE, DK, HU, IE, NL
Tourism / recreation	AT, CH, DE, HU, NL, NO
Physical planning	DE, FL, HU, PT
Cultural education / identity	DE, DK, HU, PT

TABLE 6.3. Contacted stakeholders from international organisations.

Name	Organisation/website	Place/ Country	Meeting	Domain of interest
Mr Thierry de l'Escaille Ms Marie-Alice Budniok	European Landowners' Organisation (ELO) http://www.elo.org	Brussels / B	09.02.2004	Contribution of private landownership to the economy and environment management of rural areas
Ms Lisa Davies	European Travel Commission http://www.etc-corporate.org/	Brussels / B	09.02.2004	Market and promote tourism to Europe
	ECOTRANS http://www.ecotrans.org/	Saarbrücken / D		Sustainable tourism, environment and regional development
Mr Luc Bas	Network of Regional Governments for Sustainable Development http://www.nrg4sd.net	Brussels / B	26.02.2004	Promote sustainable development at the regional government level

On the Internet, we searched for stakeholders of relevant international institutions and of equally organised private sectors. In particular, we sought stakeholders that are active in the domains of sustainable development, land use management, agriculture and tourism are of interest. Relying on landscape qualities to achieve the particular objectives of their resource management, but at the same time affecting these qualities to a great extent, such persons play a decisive role in the development of landscapes. Indeed, their attitudes towards landscapes and the way they take landscape qualities into account when executing their planning and management initiatives, are crucial to maintain landscape character and hence landscape identity throughout Europe. Contacts are established with the stakeholders mentioned in the table below. For the time being, we will concentrate on these stakeholders. When adopted by these organisations, the ideas developed in ELCAI may be propagated effectively to the different target groups.

6.2 International policy instruments[1]

At the European level, the following policy needs for improving a common understanding of the character and distribution of landscapes can be recognised:

- The legislative protection of landscape elements, i.e. habitats, biotopes and features (both natural and anthropogenic). This type of protection may extend to components of the countryside throughout the territory or may be specific to designated areas, such as water catchment zones and national parks;
- The creation of designated areas ranging from national parks to small-scale local nature reserves within which various levels of protection and management of landscapes are applied. In practice, arrangements for the protection and management of these areas vary greatly within and between countries;
- Land use planning[2] rules which may influence the use of land and activities upon it, and hence the landscape, in a wide variety of ways. For example, regional and municipal land use maps and plans, development strategies (which may be defined at national, regional or local level) and development controls may all influence the management of existing landscapes and the development of new ones. Many planning rules concern construction activities, including the erection, alteration or use of buildings, infrastructure development etc. In some countries, land use controls extend to agriculture and forestry. In others, rural land use may be acknowledged in local plans but otherwise is largely unregulated;

1 This section contains contributions by Dirk Wascher and Isabel Ripa Julia (formerly UNEP-WCMC), the latter having provided input for an earlier draft publication on European landscapes in the framework of a contract with the European Environment Agency.
2 A variety of planning terms are employed across Europe, including physical planning, regional planning, rural planning, town and country planning, development planning, etc.

- The control/prohibition of certain types of agricultural practice, such as drainage, irrigation, cultivation, including the conversion of grassland to arable by means of regulations, conditions attached to agricultural grants, etc.;
- Schemes providing farmers, foresters or other land managers with positive economic incentives for adopting a particular form of land management. These payments may compensate landowners for not proceeding with potentially damaging activities or they may provide an incentive for the maintenance of landscapes. Such schemes may apply to eligible land nation-wide or be targeted to specific areas;
- Voluntary initiatives, for example the provision of information, advice and guidance on landscape management, both to private owners and to local communities and planning authorities. Another activity is punctual management of landscape features by volunteers.

In some countries, these policy measures are complementary, e.g. incentive schemes for specialised management are often targeted to areas designated for nature or landscape conservation. Others may conflict, for example, although a landscape may be protected by means of management rules or schemes within a designated area, damaging developments in the same area may be favoured in the planning authority's land-use strategy. With the exception of the protected area (see Section 6.2) and landscape planning (see Section 6.4), the above measures are discussed in more detail in the following paragraphs.

Habitat protection

Traditional landscape features are protected to some degree by land use planning procedures in most Member States. In addition, some Member States use legislative measures to protect the landscape. As mentioned earlier, Denmark has the most comprehensive legislation (Bennett 1996), including the general protection of habitat types such as all permanently unploughed land larger than a minimum size.

Many habitat protection measures involve the designation of areas of farmland of high conservation value and the agreement of a management plan that the farmer may enter voluntarily and for which payments are made.

Voluntary measures

Voluntary guidelines and advice are provided to farmers in most European countries. However, their contribution to the protection of landscapes is difficult to assess. Codes of Good Agricultural Practice are found in some Member States but the extent to which farmers are influenced by them has often been little evaluated. In the UK, Codes of Good Agricultural Practice for the protection of water, air and soil have been available for some time but a recent survey suggested their impact was limited. Farmers are unlikely to implement management practices which threaten, or are perceived to threaten, their income without compensation or incentive payments.

A semi-voluntary policy approach is that of cross-compliance[3], whereby environmental conditions are attached to agricultural support payments. The agricultural support is optional but it could be argued that farmers are essentially dependent on it to remain competitive. In Norway, those farmers who receive payments under the main agricultural support scheme, the Acreage and Cultural Landscape Scheme, are obliged to comply with a number of provisions. The conditions prohibit: the filling of open ditches; ploughing of forest and field margins; removal of stone walls and cairns; spraying of field margins with pesticides; the blocking or ploughing of paths. Similarly, there is provision for Member States to introduce environmental conditions to some elements of the CAP, including the sheep, beef and suckler cow support measures. UK, for instance, has taken up the option to attach conditions to these support payments. The use of cross-compliance to protect landscape features has support from some Member States but little progress has been made to implement such a policy at EU level (Baldock and Mitchell 1995).

Another voluntary measure is found in Norway. It is the Environment and Resource Plan (ERP); a tool farmers may use to integrate environmental considerations into their farming practices (NOS 1999).

6.2.1 World Heritage Convention[4]

The World Heritage Convention's definition of heritage (1972) provided an opportunity for the protection of cultural landscapes as "works of man or the combined works of nature and man". In 1992 the category of cultural landscape was finally introduced into the Conventions Operational Guidelines.

The Convention, not only embodies tangible and intangible values both for natural and cultural heritage, it also acknowledged in its implementation the recognition of traditional management system, customary law and long-established customary techniques to protect the cultural and natural heritage. Through these protection systems World Heritage sites contribute to sustainable local and regional development.

With 176 States Parties and 754 (582 cultural, 149 natural and 23 mixed) properties from a total of 128 countries on the World Heritage List, the Convention became a key legal instrument in heritage conservation and plays an important role in promoting the recognition and management of heritage in many regions of the

3 Also known as environmental conditionality or eco-responsibility.
4 This section is largely based on a contribution by Mechthild Rössler to the draft version of the Millennium Ecosystem Assessment, Conditions and Trends, Chapter 18, Cultural and Amenity Services (in press).

MAP 6.1. Natural and cultural World Heritage Sites. (UNESCO 1999a).

world. Today, 35 cultural landscapes are inscribed on the World Heritage List and their protection had a considerable effect on many other programmes and projects beyond World Heritage.

With respect to cultural landscapes, the UNESCO Committee has adopted the following guidelines concerning their inclusion in the World Heritage List:

- cultural landscapes represent the "combined works of nature and of man" designated in Article 1 of the Convention;
- the term "cultural landscape" embraces a diversity of manifestations of the interaction between humankind and its natural environment; and
- cultural landscapes often reflect specific techniques of sustainable land use. Three main categories are recognised:
  1. clearly defined landscape designed and designed by man (e.g. garden, parklands);
  2. organically evolved landscape developed in close relation to natural environment; and
  3. religious, artistic or cultural associations of the natural element).

Including cultural landscapes on the World Heritage List: a new approach

In 1992 the World Heritage Convention became the first international legal instrument to recognise and protect cultural landscapes. This decision was based on years of intensive debates in the World Heritage Committee on how to protect sites where interactions between people and the natural environment are the key focus. The World Heritage Committee adopted three categories of cultural landscapes as qualifying for listing:

- Clearly defined landscapes designed and created intentionally by humans;
- Organically evolved landscapes, which can be either relict landscapes or continuing landscapes; this results from an initial social, economic, administrative, and/or religious imperative and has developed its present form by association with and in response to its natural environment. Such landscapes reflect that process of evolution in their form and component features;
- Associative cultural landscapes. The inclusion of such landscapes on the World Heritage List is justifiable by virtue of the powerful religious, artistic or cultural associations of the natural element rather than material cultural evidence, which may be insignificant or even absent.

"Protected landscapes are cultural landscapes, i.e. have co-evolved with human societies. They are areas where the natural landscape has been transformed by human actions and the landscape qualities have shaped the way of life of the people. All management approaches to these areas must be based on a clear understanding of this, often complex, inter-relationship." (Beresford 2003)

In terms of the IUCN categories, World Heritage cultural landscapes are not necessarily Category V protected landscapes or seascapes. There are diverse national protection systems, as the World Heritage Convention operates globally. In many cases protected landscapes form buffer zones of natural and cultural World Heritage sites.

The cultural landscapes inscribed on the list illustrate the complexity of the protection systems and management challenges, such as Cinque Terre (Italy), the Philippines Rice Terraces (Philippines), the Quadisha Valley (Lebanon) and Sukur Cultural Landscape (Nigeria).

6.2.2 European Landscape Convention

On 20 October 2000, the Council of Europe's Committee of Ministers adopted the European Landscape Convention and decided to open it for signature, during the ministerial conference on landscape protection in Florence, Italy. The convention aims to encourage public authorities to adopt policies and measures at local, regional, national and international level for protecting, managing and planning landscapes throughout Europe. It covers all landscapes, both outstanding and ordinary, that determine the quality of people's living environment. The text provides for a flexible approach to landscapes whose specific features call for various types of action, ranging from strict conservation through protection, management and improvement to actual creation.

The idea to draft a new legal text for better management and protection of the continent's landscapes was first proposed by the Council of Europe's Congress of Local and Regional Authorities (CLRAE) in 1994. It received strong political support from both the Parliamentary Assembly and the Committee of Ministers as part of the Council's work on natural and cultural heritage, spatial planning, environment and local self-government.

The convention proposes legal and financial measures at the national and international levels, aimed at shaping "landscape policies" and promoting interaction between local and central authorities as well as transfrontier co-operation in protecting landscapes. It sets out a range of different solutions which States can apply, according to their specific needs. The Council of Europe intergovernmental committees will be supervising the convention's implementation. The text also provides for a Council of Europe Landscape award, to be given to local or regional authorities or an NGO which introduced exemplary and long-lasting policies or measures to protect, manage and plan landscapes.

While several international policies suggest the need for reliable and targeted information on the state and trends of European landscapes, it is especially the European Landscape Convention (ELC) that requires Parties to carry out research and studies in order to identify landscapes and analyse their characteristics and the dynamics and pressures which affect them. The Explanatory Report of the ELC (Council of Europe 2000) states: *Some countries have already performed nation-wide surveys of landscapes. This work has revealed the landscape distinctiveness of different areas, each with its own mixture of natural and man-made elements. Geographical information systems and modern techniques of computerised mapping, also at urban level,*

are used to show up landscape characteristics, such as the physical relief, the settlement pattern, the main land uses, economic activities, residential areas, the presence or absence of features such as hedgerows and terraces, important wildlife habitats and the heritage of past human activity. (Paragraph C – Identification and evaluation)

Another important requirement is the need for *transfrontier programmes.* According to the Explanatory Report on Article 65 the parties are requested *to set up transfrontier programmes for the identification, evaluation, protection, management and planning of landscapes which straddle borders. In doing so, they are asked to rely as far as possible, in accordance with the subsidiarity principle defined by the European Charter of Local Self-Government, on local and regional authorities, and to use the implementation tools advocated in the European Outline Convention on Transfrontier Co-operation between Territorial Communities or Authorities in Europe of 21 May 1980 and its additional protocols.*

The European Landscape Convention is seen as being complementary to existing international legal instruments, such as:

a) the UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage, (Paris, 16 November 1972);
b) the Council of Europe Convention on the Conservation of European Wildlife and Natural Habitats, (Bern, 19 September 1979);
c) the Council of Europe Convention for the Protection of the Architectural Heritage of Europe, (Granada, 3 October 1985);
d) the Council of Europe Convention for the Protection of the Archaeological Heritage (revised) (Valletta, 16 January 1992).

The European Landscape Convention should allow establishing formal links where appropriate between the mechanisms of the convention and these other instruments or initiatives.

The European Landscape Convention leaves Parties the choice of means to be used within their internal legal arrangements to fulfil their obligations. The legal, administrative, fiscal and financial arrangements made in each country to serve the Convention's implementation should fit in as comfortably as possible with that country's traditions. It is also recognised that, on the basis of the principle of subsidiarity, responsibility for action relating to landscape lies with public authorities not only at national and international levels, but also at local and regional levels.

6.2.3 Related European policies

Pan-European Biological and Landscape Diversity Strategy

The Action Plan on European Landscapes is part of the Pan-European Biological and Landscape Diversity Strategy (PEBLDS)(Council of Europe, UNEP and ECNC 1995) that has been signed by 55 European countries and is presently under implementation. The central objective of Action Theme 4 is to actively promote the landscape concept as an opportunity to address all those pressing landscape issues which are complimentary to, but – at the European level – not sufficiently affected by, classical nature conservation approaches. Rather than being limited to area protection, the landscape concept offers integrative, preventive and pro-active tools to counteract multi-dimensional environmental pressures and to initiate large-scale mitigation and restoration processes. AT4 is hence designed to respond to the following needs: a sound, transparent and scientifically stable methodology for describing and assessing the distribution, values, and land use aspects as driving forces and trends of landscapes of European importance on the base of European-wide developed and agreed-upon criteria (landscape indicators). The Action Plan is implemented under the lead of PEBLDS's Focal Point for Action Theme 4 on landscapes, namely the Council of Europe and the European Centre for Nature Conservation. The Action Plan specifies projects and actions on developing a European Landscape Map, identifying landscape assessment criteria, analysing future trends and opportunities and initiating awareness campaigns as well as policy debates. Since the implementation begun, reports on landscape assessment (Klijn *et al*. 1999), progress on the landscape map (Vervloet 2000) and a European Workshop on 'Landscape and Sustainability (Wascher 2000) have been completed.

The Convention on Biological Diversity

In June 1992 the global Convention on Biological Diversity and Agenda 21 towards sustainability were signed by over 150 countries and the European Union at the Earth Summit. The Earth Summit confirmed that only through integrating conservation and development could human and ecological challenges be met. This Convention is the first global instrument to take a comprehensive approach to the issues of conserving the world's biological diversity and to using its biological resources in a sustainable way.

Substantial work is ongoing world-wide through programmes and activities that take a comprehensive natural resources management perspective and address agricultural biodiversity at ecosystems and landscape level (UNEP 1999). According to Article 8(j) of the Convention on 'in-situ conservation', each Contracting Party shall 'subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge, innovations and practices.'

Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention)

A primary obligation for member states is to promote the wise use of wetlands, which means that any use must be sustainable and compatible with the maintenance of a site's ecological character. All EEA Member Countries are party to the Ramsar Convention. Many European wetlands have been designated. For example, Denmark

currently has the most extensive network of 38 Ramsar wetlands in Europe covering 2,283,013 ha, while the UK had the largest number of sites (150) covering 720,640 ha (May 2000).

Integration into sectoral policies
Recent policy developments include the sectors of transport, regional planning and – most importantly – agriculture. In the field of agriculture, landscapes have become policy issues both the European and the global level. In 1998, European Commission launched a FAIR research project on agri-environmental indicators and took the lead on the topic of landscape indicators during the event of an OECD Indicator Workshop in York, September 1998. The paper presented by ECNC (Wascher *et al*. 1998) was the starting point of integrating landscape as an environmental concern at the level of OECD and ultimately of the World Trade Organisation (WTO). The workshop led to the inclusion of three landscape indicators and the request to provide internationally standardised geo-references for landscapes.

6.2.4 IUCN Category V Areas

Quite apart from meeting their obligations with respect to international conventions and European Union Directives, as discussed in Section 6.1, all European countries have established national systems of protected areas, which include provisions for conserving landscapes. While there is no common, agreed, term used at European level for landscapes that are legally protected, they share common management objectives. In countries such as Austria, Germany, Norway, Portugal and Switzerland, *Landscape Protected Area* is a legal designation. Other countries have designations with a similar emphasis on landscape conservation, for example: Greece – *Aesthetic Forest*; Spain – *Natural Landscape and Natural Landscape of National Interest*; and United Kingdom – *National Parks*, *Area of Outstanding Natural Beauty* and *National Scenic Area*.

In order to simplify the diverse array of protected area designations applied throughout the world, the World Conservation Union (IUCN), through its World Commission on National Parks (formerly Commission on National Parks and Protected Areas), classified them into six types based on management objectives provided in the national legislation (see Box 6.1). Under this system, provision is made for *Protected Landscapes/Seascapes, which are 'protected areas managed mainly for landscape/seascape conservation and recreation'*.

A protected landscape is an area of land, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Under IUCN Management Category V, protected landscapes meet the more general definition of a protected area which is:

'*An area of land especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means*'.

Some of the objectives of management for protected landscapes are listed in Box 6.1.

The share of total expenditure on biodiversity, habitats and landscape as a percentage of the total Producer Support Estimate (PSE) for 1998 is as follows: Canada: < 1%; Norway: 20%; Poland: < 1%; Switzerland: 4% and EU: < 1% (the % for EU is higher than shown here as only nine member States are included in this calculation, while the PSE covers 15 Member countries).

Based on the IUCN management categories system, it is possible to quantify the extent of protected landscapes with respect to both the area of a country and its protected areas system. Information on internationally and nationally protected or designated areas are at present being collected in a common database of European protected areas, thorough a collaborative process involving the Council of Europe, the European Environment Agency and its Topic Centre for Nature Conservation, and the World Conservation Monitoring Centre. Information on IUCN categories is not always available from countries. As a result of this collaboration, the Common Data Base on Designated Areas in Europe (CDDA), holding 29,000 records for EEA member countries has been officially launched in Spring 2000.

It should also be noted that the analysis does not imply any judgement about the effectiveness with which a protected landscape is managed. While it is generally recognised that there are wide variations in the effectiveness with which authorities and owners are able to manage their protected areas, the IUCN classification system is based on management objectives and not management effectiveness.

Subject to these constraints, the following picture emerges from the available data:

- The growth of protected landscapes (IUCN Management Category V) in Europe has outstripped other combined categories of protected area since

BOX 6.1. Six IUCN Management Categories for Protected Areas (IUCN, 1993).

I. Strict Nature Reserve/Wilderness Area. Protected area managed mainly for science or wilderness protection.
II. National Park. Protected area managed mainly for ecosystem protection and recreation.
III. Natural Monument/Natural Landmark. Protected area managed mainly for conservation of a specific natural feature.
IV. Habitat and Species Management Area. Protected area mainly for conservation through management intervention.
V. Protected Landscape/Seascape. Protected area managed mainly for landscape/seascape protection and recreation.
VI. Managed Resource Protected Area. Protected area managed mainly for the sustainable use of natural resources.

MAP 6.2. IUCN Protected Areas Category V "Landscape" in Europe. (UNEP-WCMC 2004)

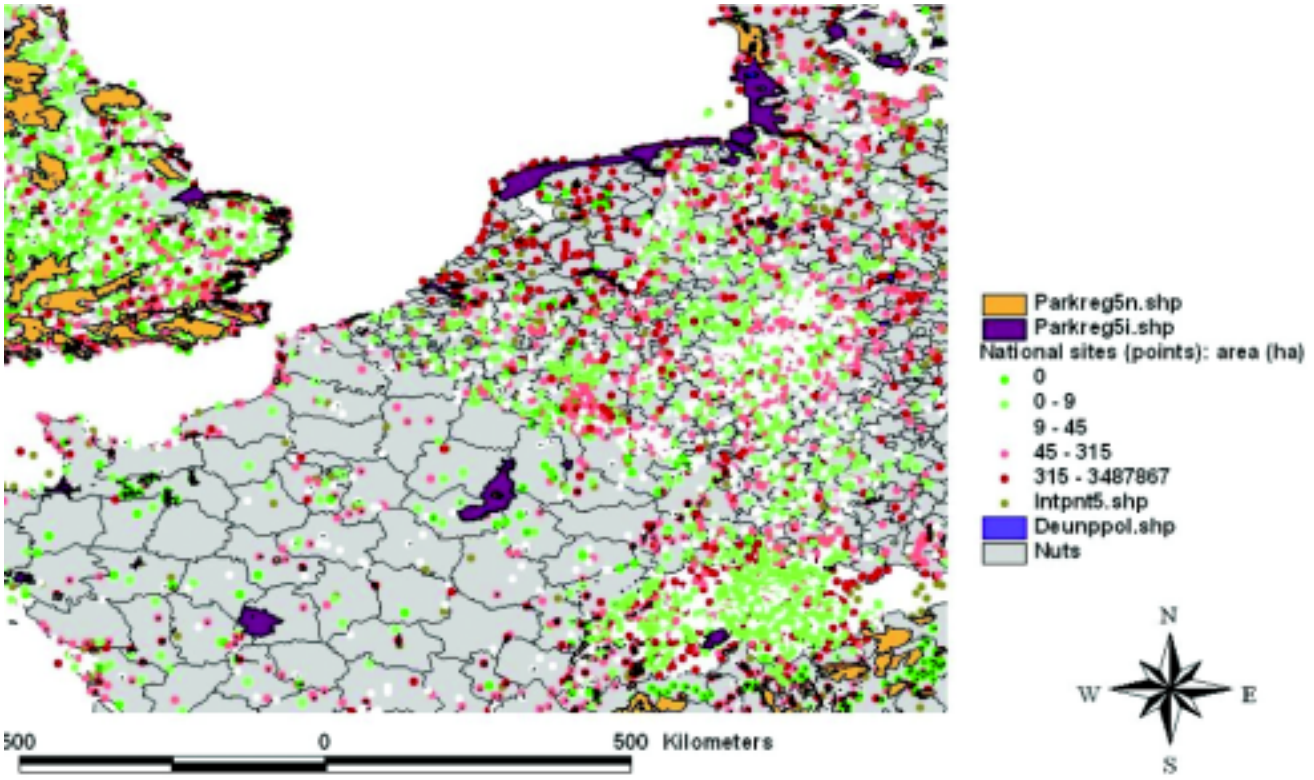


TABLE 6.4. Landscape conservation schemes and funding for selected countries in 1998. (OECD 2001)

Scheme	Objective	Area ('000ha)	% of agric. area	1998 US$ ('000)
Austria				
Mountains and less favoured areas	Landscape	1 214	35	238 301
Finland				
Supplementary Protection (SPS)	Landscape	173	6%	37594
Greece				
Maintainance of Landscape elements	Landscape	–	–	5 594
Japan				
Yusuhara village	Landscape	–	–	31/ha
Kiwa village	Landscape	–	–	23/ha
Wajima village	Landscape	–	–	20/ha
Yuhuin village	Landscape	–	–	0.458/ha
Netherlands				
Landscape conservation subsidy	Landscape	–	–	623
Landscape and farmyard planting	Landscape	0.150	< 1%	1 246
Landscape elements (Province)	Landscape	–	–	2 928
Norway				
Area and cultural landscape	Landscape	1 050	102	524 165
Preservation of buildings	Architecture	370		
Local management of areas	Landscape	x	1 590	1 590
		50 x		
Portugal				
Maintaining traditional farming	Landscape	439	11	46
Sweden				
Conserv. Biodiv. and cultural heritage	Nature and Culture	1 583	51	140 242

The share of total expenditure on biodiversity, habitats and landscape as a percentage of the total Producer Support Estimate (PSE) for 1998 is as follows: Canada: <1%; Norway: 20%; Poland: <1%; Switzerland: 4% and EU: <1% (the % for EU is higher than shown here as only nine member States are included in this calculation, while the PSE covers 15 Member countries).

the early 1950s, in terms of both numbers and total extent (Figure 6.1).

- The protected landscape category (V) accounts for half the number of European protected areas (>1,000 ha) and two-thirds of the total area under protection.
- In some countries, such as Belgium, France, Germany, Luxembourg and UK, protected landscapes account for over 90% of their protected areas systems. Only in Scandinavia countries, Greece and the Netherlands do categories other than protected landscapes predominate.

Protected landscapes may be managed by central, provincial or local authorities, and parts of them may be privately owned and managed, subject to national legislative provisions. Acquisition of land by private or public bodies may be considered as a special form of area protection. In some countries these areas are small and managed by voluntary organisations. The objective of such initiatives is usually the conservation of species and habitats, rather than entire landscapes. Land acquisition is relatively common in Denmark, Germany, the Netherlands and the UK.

There are other forms of designation which do not automatically confer protection but may influence land use planning decisions. In general, designations as areas such as ESAs do not provide protection but give the possibility for management of landscape elements. In the UK, Environmentally Sensitive Areas are not protected from development but local authorities are encouraged to take their environmental values into account as part of the planning process. In Portugal, the area 200–500 m inland from the shoreline is protected from development, although numerous exemptions are allowed, and in Denmark the zone reaching 300 m inland from the shore.

6.3 National Policy Survey on Landscape Character Assessment

6.3.1 Methodological approach

In order to analyse the current use of Landscape Character Assessment for policy development, implementation and monitoring and to compare information on national and international landscape policy, a policy checklist prepared by ECNC was sent in July to all countries participating in ELCAI project: Austria, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Ireland, the Netherlands, Norway, Portugal, Spain, Switzerland and the UK. The policy checklist is a questionnaire containing six sections:

1. Section One enquires about the definition of Landscape Character Assessment used by each country in order to get an understanding of the national perception of the concept. At the time of sending the checklist, no common LCA definition was developed for ELCAI.
2. Section Two identifies policy sectors (agriculture, tourism/recreation, spatial/rural development, housing/town planning, landscapes policies, economy, cultural education) for which LCA is used and describes the relevant policy objectives giving relevant examples.
3. Focused on the given examples, Section Three describes the instruments for policy development and implementation and for monitoring/evaluation of policy of each country.
4. Section Four is based on the LCA tools that have been applied describing the advantages and disadvantages for using certain tools.
5. Section Five reflects the potential use of LCA in the policy field in each country in order to identify how ELCAI project results can be further applied in the policy and in practice and how it can more strongly be promoted.
6. Additional information connected to the method used by the countries to fill in the checklist (i.e. contact points, literature reviewed, web sources) is compiled in Section Six.

For filling out the policy checklist, information for national policy overviews has been collected by the respondents through:

- review and analysis of relevant legal instruments (acts, decrees);
- review and analysis of different sectoral strategies, development plans, protection schemes and subsidy schemes;
- analysis of landscape planning documents, plans and programmes;
- use of internet sources; and
- interviews with relevant authorities and policy-makers.

6.3.2 Results

Ten out of the 14 countries participating in ELCAI returned a completed policy checklist. Due to lack of time and financial resources it was not possible for participating countries to do a full range survey of LCA such as approaches and studies conducted at the regional or provincial level. The extent to which the questionnaires have been filled out varies a lot by country. This, in addition to the differences in LCA definition by country, limits the possibilities for analysis as part of this survey.

Comparisons between the countries on the development of LCA cannot be established due to the different approach in the information given by the countries in the policy checklist. Also statistics cannot be calculated due to the different stage at which the process of implementing LCA into national policies policy is in every country.

Findings related to the current, potential and shortcomings in the use of LCA have been summarised and illustrative examples that display the stage of the process to incorporate LCA into national policy have been selected.

The analyses as formulated in the next sections are therefore to be seen as general findings, based on samples throughout Europe, rather than statistically valid facts about the actual state of LCA in national policy.

Policy requirements and the use of LCA

Before analysing what is happening, it is important to start from the question 'What is required'. In the current report, the focus of this question is on what is required by national policies in relation to LCA.

National policy objectives, which might be relevant for the use of LCA from the considered countries, are listed for each of the sectors.

Agriculture
- evaluation of agri-environmental programme;
- promotion of the development of new and better agricultural practices considering the natural heritage (natural and cultural environment);
- optimisation of agriculture, increase of cost-effectiveness by improving spatial organisation;
- guarantee sustainable soil fertility and a long-term usability of areas;
- preservation of the landscape character by improving land use;
- landscape protection for achieving sustainable development;
- development of regional targets;
- increase organic farming;
- increase ecological compensation areas; and
- maintenance of cultural diversity.

Fishery
- protection of the water bodies; and
- promotion of habitats for native animal and plant species.

Forestry
- sustainable forestry;
- favour native and adapted species;
- respect the function of the forests (tourism);
- favour forest reserves for endangered species;
- conservation of the native forest plants; and
- expansion of the forest area.

Tourism and recreation
- setting priorities for subsidies and incentives in the tourism sector;
- sustainable tourism;
- nature conservation, biodiversity and landscape protection;
- explore niches in tourist demand (mountain adventures);
- conservation of areas with recreational purposes;
- development and improvement of walking routes and cycling trails; and
- management of the landscape as a sustainable resource for tourism industry.

Spatial and rural development
- spatial planning, taking into account regional identity;
- reporting on the sustainability of land use;
- limit expansion of settlements and promote inward development;
- concentrate harmful production to the environment to a few limited places;
- encourage energy saving in building construction and maintenance;
- encourage communication technology to reduce transportation;
- create and maintain valuable settlements, urban environments and landscapes;
- enhance value in rural areas with protection landscape measures; and
- coastline management integrating landscapes.

Housing and town planning
- consideration of natural landscape structure during the planning process; and
- nature protection on the land use.

Landscape
- assessing nature value;
- sustainable protection of native animal and plant species;
- support the international efforts within the European community in the field of nature protection and landscape conservation;
- identification of landscapes to be protected;
- prevention, minimisation or elimination of impairments of nature and landscape;
- protection, conservation and development of certain parts of nature and landscape as well as the biotopes and biocoenoses of wildlife animal and plant species;
- formation and protection of the European ecological network 'Natura 2000';
- protection, improvement of the quality and regeneration of soils, water bodies, air and climate;
- preservation and development of the diversity, character and beauty of nature and landscape as well as space of experience and recreation; and
- give public access to stay in nature and to improve the options for outdoor life.

Nature protection, natural and cultural heritage
- conservation and management of endangered species;
- maintain recreational quality of the landscape;
- implement participatory rules for large conservation areas;
- implement the concept of Red List;
- maintain cultural diversity of the landscapes of the country;
- restoration of rivers; and
- management of cultural heritage in a landscape context.

Cultural education
- conservation of cultural landscapes;
- designation of valuable cultural landscapes;
- interest in cultural-historic aspects of the landscapes; and
- promote public awareness of landscapes (relationship between nature and society).

Energy production
- river restoration;
- support the local cultural heritage, maintaining decentralised work places;
- maintain and guarantee attractiveness and accessibility of hydroelectric lakes for the tourists; and
- mitigate or avoid visual and biological landscape impact (wind energy).

Water management

- protection of coastal settlements by decreasing the effects of floods and droughts;
- protect and improve aquatic ecosystems (discharges, emissions, etc.); and
- promote sustainable water use based on long-term protection of available water resources.

Transport

- support sustainable public transport.

Mineral extraction

- promotion of natural succession, renaturation, composition close to nature, rehabilitation or recultivation of the landscapes.

6.3.3 Purposes for using LCA

The previous section has described by sector those policy objectives that require or relate to LCA at national level. In order to identify whether these requirements are met by applications of LCA, this section provides an overview of the types of use that is currently made of LCA in the respondent countries.

Based on the country samples, Landscape Character Assessment is used:

- to raise awareness with decision makers and the public on the importance of landscapes (for sustainable development, quality of life, cultural heritage, identity);
- as a tool to map landscape units that are homogeneous in terms of their character;
- as one of the components in environmental and social impact assessments, in addition to other components such as flora and fauna, noise, air pollution, etc.;
- as a basis for monitoring changes in the character of the landscape, including the setting of a baseline situation and identification of landscape indicators;
- as a framework for public participation, allowing a multitude of local stakeholders to participate in the identification and implementation processes regarding the landscapes they create and/or enjoy;
- to provide a common language for debate about landscape-related issues by adopting common definitions and applying a standard terminology (also for use in cultural education);
- as a marketing tool where it regards components related to aesthetics and perception (to 'sell' a region as a good place to recreate, to live or to work, supporting rural development efforts);
- to improve the recognition of landscape character in planning processes (such as land consolidation and spatial development plans);
- to evaluate the effectiveness of agri-environmental programmes and measures for biodiversity and structural landscape features;
- as a tool to identify areas to be designated (protected landscapes, nature reserves, environmentally sensitive areas, nature restoration areas, afforestation zone, areas eligible for subsidies, etc.);
- as a part of management plans (e.g. landscape management, forestry, species or habitat management);
- as a basis for suitability analysis of a region for certain land use types (e.g. recreation, dam construction, wind farms);
- as a tool in reaching the aims of the European Landscape Convention; and
- as a tool for risk prevention (e.g. flood control, erosion risk, coastal protection).

6.3.4 Bottlenecks in the use of LCA

The samples in the policy checklist demonstrate that currently there is a wide range of bottlenecks that limit the full use of LCA at national level. The most important shortcomings observed are listed below:

- Lack of experience, knowledge and information about the potential use of the system.
- Differences between policy goals with different level of authority vary between geographical levels and sectoral interests/goals often govern landscape development. Many countries have a federal structure with responsibility for nature and landscape at regional level.
- Due to the lack of commitment and articulation of national landscape objectives at national level, local authorities are undertaking LCA independently of each other and in absence of a national framework.
- The link between the description of the landscape character and the landscape assessment valuation is unclear because there are no uniform (standardised) parameters and tools. There is a lack of accepted 'hard' landscape indicators.
- LCA is perceived as a tool to judge, control and assess 'negative' developments, instead of evolving towards a more positive attitude: showing, understanding and promoting positive actions and developments.
- There are countries were LCA is actively used but integration of the outcome of LCA into policy development or landscape plans is lacking.
- Sectors often use their own assessment frameworks and regional distribution instead of using an integrated approach. The existing landscape maps and descriptions are used mostly for traditional scientific analyses without considering interaction of landscape elements.
- Certain authorities believe the LCA process is not sufficiently sophisticated to address the complexity of landscape quality, management and change, except in specific sectors (wind energy, forestry, infrastructure developments).
- Due to limited resources, the number of samples for conducting field surveys for biodiversity assessment or the assessment of landscape aesthetics is insufficient for allowing proper statistical procedures. In addition those administrations that are interested in having the impact of their policies assessed do not trust expert judgements.
- Visual aspects are often not included in the synthesising planning procedure and politicians consider designating valuable landscape a subjective criteria and no harmonisation between method and criteria.
- There is still a lack of awareness and sensitivity for landscape and need for landscape management,

both by private and public authorities, at local, regional and national level.

6.3.5 Future developments in the use of LCA

In order to create a picture of how the bottlenecks, as described in the previous section, will be taken up countries were asked to describe which steps would be taken for future LCA application at national level. The following plans have been identified:

- Most countries show an enormous interest in applying LCA in all sectors in the future (tourism industry, forestry, etc.).
- There is a growing interest in public participation in planning processes, increasing public awareness and knowledge about impacts of social developments on landscape.
- There is a wide potential for use of LCA in planning at the local level and for using it in reporting at national /regional levels. Also it can serve as a basis for landscape consideration in the revision of the local master plans (e.g. regional plans), and also in designing of environmental policies, forest plans, etc.
- In conjunction with other tools/approaches LCA will increasingly become a part of effective landscape management.
- There is the intention of developing a LCA-based method to be implemented in the sector policies, the regional planning procedure and further as an aspect of EIA.

6.4 The stakeholder perspective

During the Utrecht Meeting and at several of the individual contacts, stakeholders illustrated their awareness concerning the integration of landscape character in their field of work. Some of them also provided elaborated examples of their activities related to landscape. This information enables us to draw conclusions regarding stakeholders' expectations and the deliverables which could suit best.

Other contacts resulted in an immediate co-operation with stakeholders: ELCAI partners were invited to participate actively in the events they organised. This proved to be excellent opportunities to disseminate opinions and examples of Landscape Character Assessment to an interested audience.

6.4.1 Wine and Vine Inter-professional Technical Centre (ITV)

The Wine and Vine Inter-professional Technical Centre, (ITV), France, develops a lot of environment related activities in the ITV Environment Pole of Epernay. We summarise the objectives and achievements of these activities, according the contribution of the representatives of ITV at the Utrecht Meeting (Utrecht contribution, Joël ROCHARD – Laurence STEVEZ).

Regarding the landscape topic, the main applied research concerns a typology of wine landscapes with the purpose:

- to identify the sensitive and strategic points of the vineyard, with the aim to protect and manage the wine landscape and its specificities; and
- to highlight the vineyard better, within a tourist framework and to confirm the brand image of wine.

Achievements of this research are the identification of the main elements of a wine landscape, i.e. geomorphology, vine training, plot characteristics, fixed elements, towns and villages in the vineyard, the water network. Currently, landscape experience is being studied, i.e. scale and openness of wine landscapes, landmarks, the composition of the landscape image. It is clear this approach comes very close to Landscape Character Assessment.

ITV has clear motives for this engagement when they recognise the importance of non-rural residents in current land use appreciation. So ITV states that "*if land use is more and more claimed by citizens, wine-growers remain one of the main actors of wine landscapes. They create, reshape and maintain the landscapes*". Besides, "*management, preservation and valorisation of wine landscapes are more efficient and successful if the actors of the wine landscapes are involved*". Hence, "*one of the actions consists of making professionals aware of their part but also their duty towards wine landscapes. Communication has to stress upon stakes linked to wine landscapes*". But because initiatives have to be executed on a landscape level, it is the opinion of ITV that a variety of actors should be involved, ranging from wine unions and tourism offices to citizens associations, local communities and public institutions, active in the field of environment and agriculture.

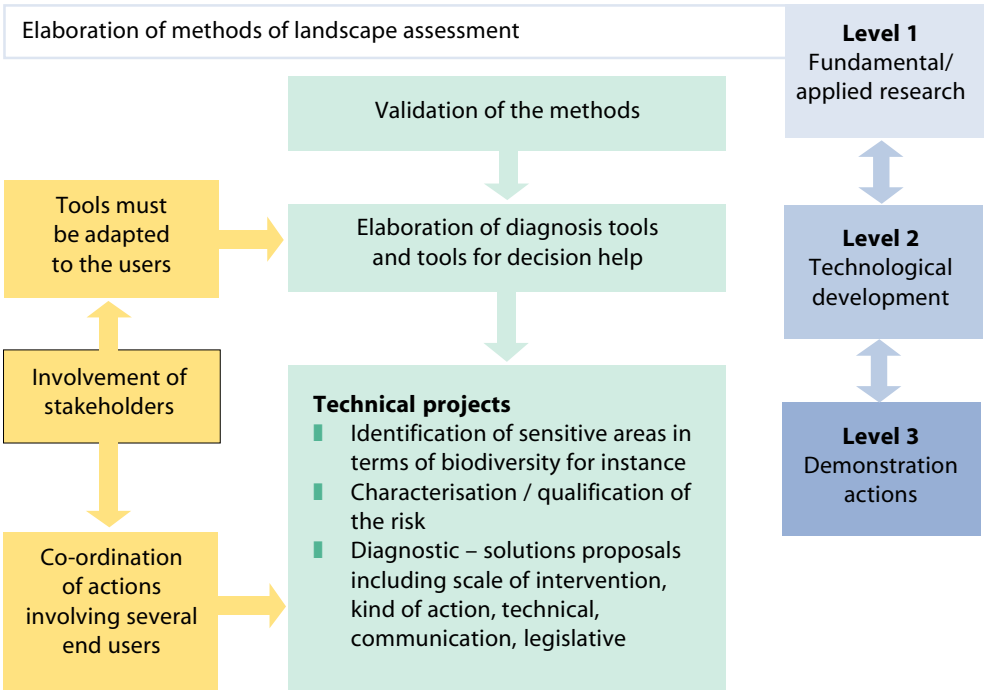
From this line, ITV sees three levels in the development of Landscape Character Assessment. Stakeholders' involvement is structured accordingly.

Herewith the crucial role of a service organisation that operates within a particular economic sector is demonstrated. Starting from their mission, they stimulate original but applied research, disseminate results and facilitate applications. Due to their central position in the sectors' organisation and the agreed assignment, they are very effective in stimulating discussions about new objectives, in advising and in promoting new developments. For initiatives that were launched from outside the sector, co-operation with these service organisations is most desirable when it is the aim to raise awareness for items that are not part of the core business of that economic sector, to spread ideas and to ensure adaptation of results. Thus, ELCAI should profit from such contacts.

6.4.2 Countryside Council for Wales (CCW)

Another important stakeholder, present at the Utrecht meeting, was the *Countryside Council for Wales*, (CCW). The Countryside Council for Wales is the government's statutory adviser on sustaining natural beauty, wildlife and the opportunity for outdoor enjoyment in Wales and its inshore waters. Besides, it is the national wildlife conservation authority. To achieve these goals, CCW

Figure 6.3. Stakeholder Scheme 4. Parts of stakeholders – the view of Wine and Vine Inter-professional Technical Centre (ITV).



tries to "*increase people's understanding and appreciation of the countryside, its wildlife and habitats*". The government, local authorities as well as landowners and land managers are their target groups. Initiatives are launched which "*help those who work in the countryside to strike a balance between sustaining country products, such as timber and food, with maintaining landscape character and wildlife*". "*Promoting access to the countryside for enjoyment whilst respecting the landscape, wildlife, work patterns and rural traditions*", are other objectives directly related to landscape (information http://www.ccw.gov.uk).

During the discussions, the application of landscape data and Landscape Character Assessment to achieve the objectives of the Countryside Council for Wales was illustrated. Focus was directed to LANDMAP, an information system for taking landscape into account in sustainable decision-making, which was devised by government bodies in Wales including the Welsh Development Agency. It gathers, organises and evaluates information about landscape into a nationally consistent data set. LANDMAP information has many applications. By identifying the important qualities in a landscape, it can help for instance to ensure that they are managed sensibly, whether for rural land uses, for amenity and enhancement, or for development. Detailed information about LANDMAP can be found on the website of the Countryside Council for Wales, http://www.ccw.gov.uk and on http://www.ccw.gov.uk/Images_Client/GeneralInfo/Landmap%20C.pdf for the full description of the methodology.

LANDMAP turned out to be of special interest for ELCAI because of the many similarities regarding methodology and application. Besides, it is a landscape description and assessment project that has been used in current regional landscape and development policies. In that way, it serves as an excellent example to learn from.

Because of the synergy between LANDMAP and ELCAI, the Countryside Council for Wales invited Landscape Europe and ELCAI partners to contribute to the "Cardiff European Landscape Conference 2003 – Assessment and policy", Cardiff, 7–9 December 2003. With examples from Hungary, Portugal, Austria, Brittany and Flanders, concepts and methodologies of Landscape Character Assessment, gathered within the frame of ELCAI, were presented and discussed. The result was a fruitful co-operation that yielded benefits for the Countryside Council for Wales and LANDMAP as well as for the ELCAI project. Ideas, gained during this conference will carry over into the final conclusions of ELCAI.

6.4.3 European Landowners' Organisation, (ELO)

The European Landowners' Organisation is the interest group of rural landowners and entrepreneurs. The objectives of the organisation are "*to ensure that the policies of the European Union promote a prosperous and attractive countryside, and that private landownership can continue to make a positive contribution to the economy and environment management of rural areas*". ELO represents landowners throughout Europe. To achieve its commitments, ELO advises on draft European legislation, provides and disseminates information to its members, organises forums and conferences to discuss rural development affairs, encourage active participation of landowners in

regional and local rural policy implementation and promotes 'best practice' of combining job and income creation in the countryside together with successful land use planning, biodiversity and landscape preservation and awareness for the environment.

The European Landowners' Organisation is convinced that paying attention to the landscape character and the regional identity or – even better – starting from the specific landscape qualities and the multifunctional land use when developing activities, would yield profit for the private landowners. Therefore, European rural policies, especially the Common Agricultural Policy and Natura 2000, gain a lot of attention. ELO's starting-point is that only a mutual partnership of all the stakeholders, landowners, farmers, NGOs and competent authorities can ensure that the countryside is managed to meet the expectations of society. Re-orientating farming and land management practices is therefore a valid option. In this respect, ELO promotes the establishment and operation of 'environmental farms', which have as objectives "*biodiversity gain and landscape enhancement, with agricultural production systems utilised more as a mean to achieve this end, and not as the primary revenue earner*" (Baily and di Marzio 2003).

These ideas were discussed during a meeting at the ELO secretariat in Brussels (9 February 2004). At that occasion ELO showed great interest in ELCAI. From that meeting and from their publications (e.g. the monthly newsletter 'Countryside') it became clear that a landscape reference system with landscape characterisations would be of help for the organisation. Indeed, when they promote activities in harmony with the surrounding landscape, a reference system would enable them to define the criteria that have to be met in order to achieve the goal. Further contacts must explore the opportunities for closer co-operation in future.

6.4.4 The Network of Regional Governments for Sustainable Development (nrg4SD)

The Regional Government Network for Sustainable Development was founded by a group of regions committed to policies of sustainable development which found that not being states hindered their work in an international scenario. Among others, *promoting sustainable development at the regional government level throughout the world and sharing information and experience concerning sustainable development policies with regional governments*, are main objectives (information source http://www.nrg4sd.net)

In Europe, the following regions are active members: Tuscany (I), Flanders (B), Catalonia (ES), Basque-Country (ES), North Rhine-Westphalia (D), Wales (UK), Tulcea (RO), and Kaunas (LI).

For the Network maintaining landscape identity is an integral part of sustainable development. Achieving sustainability thus implies that landscape character is taken into account to the fullest level. The representative of the network was convinced of the importance of tailored Landscape Character Assessment as a starting point for the sustainable development of regions and hence confirmed that ELCAI was of great interest to them. For ELCAI the Network could serve as a transfer point to disseminate information to potential users. Their conferences offer good opportunities to do so, because they bring together politicians, policy makers, managers and academics. Therefore, ELCAI was invited to contribute to the 4th Conference in Wales, 'Challenge and Opportunity', 22–26 March 2004. Amongst others, culture and identity, tools and indicators, and tourism, will be discussed. A paper was prepared, summarising the background and content of ELCAI and presenting some applications of Landscape Character Assessment.

6.4.5 European Travel Commission (ETC)

ETC is a non-profit making organisation whose role is to market and promote tourism to Europe in general, and to their individual countries (33 National Tourism Organisations are members) in particular. ETC endorses that landscape character is of great importance to tourism. Although, they are not in a position to contribute directly to ELCAI, sister-organisations such as ECOTRANS (http://www.ecotrans.org/) are better placed to be involved. ECOTRANS is a European network of experts and organisations in tourism, environment and regional development, who are seeking to promote good practice in the field of sustainable tourism. Contacts have yet to be established. The national tourism boards are other potential stakeholders. During our visit to ECT, a list with the most promising contacts was drawn up.

6.5 Conclusions

Most, if not all, Member States have legislation which affects landscape either directly, e.g. through protection of features, or indirectly, mainly through restrictions or lack of restrictions on agricultural practice. The number, extent and enforcement of such policies vary considerably. The majority of policies of interest tend to be concerned with:

- providing information, advice and guidance on landscape management, both to private owners and to local communities and planning authorities;
- the protection of landscapes, habitats and biotopes and historic features. Often this depends on the creation of designated areas ranging from national parks to small-scale local nature reserves. In practice, arrangements for the protection and management of these areas varies greatly within and between countries;
- land-use planning, including the control of farm buildings, urban development on farm land, etc., and more positive forms of landscape planning;
- the control/prohibition of certain types of agricultural practice, such as drainage, irrigation, cultivation, including the conversion of grassland to arable. While this control may be exercised through land use planning procedures, there are other mechanisms, including regulations, conditions attached to agricultural grants, etc.;
- schemes providing farmers, foresters or other land managers with positive economic incentives for

adopting a particular form of land management. These payments may compensate landowners for not proceeding with potentially damaging activities or they may provide an incentive for positive management such as restoring degraded habitats.

These policies to guide management of the landscape and protect important features often apply throughout the countryside but the main focus of Chapter 6 is on the farmed landscape. A brief review of obligations placed upon landowners and farmers in European countries provides a good illustration of the considerable variation in the pattern of regulatory controls.

Protected landscapes have a wide application for the protection of man-modified environments which best show how man and nature can coexist. The importance of the conservation of landscapes is recognised by the governments, and therefore different legal designations protect these areas.

There is no straightforward interpretation of these results possible, as the designation of protected areas is subject to economic and political constraints and influences. In countries where the influence of human use on the ecosystems has been greater, protected landscapes (or similar designations) are widely represented in the protected areas system; in countries possessing more natural and semi-natural ecosystems these are less common, and more restrictive protection measures are favoured.

There is a great potential to develop the designation of protected landscapes in the south of Europe, where there is a tradition of interaction between human and natural environment that has nurtured valuable landscapes still not protected, mainly through traditional agricultural practices.

As stated in the Dobríš Assessment, the protection of landscapes is European concerns – the regional diversity and uniqueness of landscapes is a common European heritage.

6.5.1 Policy conclusions

A policy checklist based on the use of Landscape Character Assessment for policy development, implementation and monitoring was sent to 14 countries and provided a broad overview on the current application, shortcomings and further developments in the use of LCA.

- For every country LCA has a different meaning, and it was noticed that the questionnaires were filled in according to the national definitions. Therefore there are different views on what qualities and elements of the landscape the assessments should focus on. Some countries had difficulties understanding precisely the information requested.
- Derived from the lack of a common definition of LCA there is no standard indicators to assess the landscape character between regions and countries and guidelines of how to use existing LCA should be formulated.
- Due to different environmental approaches in the LCA, there is the need of unifying criteria and co-ordination among authorities to carry out an integrated approach at local, regional and national level. It would also be very useful to develop a typology that, used consistently among European countries would enable local and regional authorities to assess their own landscapes in a European context. Some work would therefore be required to systematise existing knowledge and come to agreement on international guidelines.
- The lack of experience and knowledge of the use and potential use of LCA is evident and advantages, applications and results on its use should be divulged.
- There is still a lot of work to do to promote LCA, to form and motivate administration sector and technical staff for raising public awareness on landscapes. Even if the awareness of landscape needs to be incorporated more explicitly in national policies and monitoring this awareness is nevertheless increasing progressively.
- LCA is currently used as a mapping tool to design protected areas and also as part of the management plans. It is also the basis for monitoring and evaluating features of the landscape (structure, morphology, diversity…) in all sectors, especially in the tourism, agriculture and forestry sector the interest in applying LCA is growing.

6.5.2 Stakeholder conclusions

Stakeholder contacts and the analysis of the questionnaire regarding policies and applications of Landscape Character Assessment showed that there is a broad interest in Landscape Character Assessment and in the ELCAI project. Different stakeholders agreed to share information and opinions.

Although the importance of a general approach for Landscape Character Assessment was acknowledged, there was a clear interest for tailored methodologies that suit the stakeholders' own sphere of work. From that follows that ELCAI should try to elaborate flexible methodologies and indicators that are able to meet the stakeholders' requirements.

Expectations regarding the potential use of Landscape Character Assessment fall into two types:

- the use of Landscape Character Assessment for the identification and designation of particular landscapes that are worth to be protected or to be taken care of ('landscape conservation'); and
- the use of Landscape Character Assessment for the definition and elaboration of alternative land uses, for instance in the context of multi-functionality and sustainable development ('landscape sound development').

The former meshes with the traditional approach of landscape protection policy. Survey methodologies, criteria and procedures are well established and incorporated in national or regional legislation. For this application, the further development of Landscape Character Assessment may call on existing experiences.

The latter is more challenging and needs thorough analyses. Landscape Character Assessment is not geared to such a purpose but nevertheless yields the basic data for the analysis. We should decide whether or not ELCAI can meet this goal. Anyhow, we must be clear towards the stakeholders about the level of ambition of ELCAI in this respect.

Stakeholders ask for a sufficiently sophisticated methodology that allows handling the complexity of current landscape character. Methods should especially pay attention to the integration of 'fixed' landscape features such as the biophysical components, cultural history elements, land cover, with the dynamics that (can) occur and the various degrees of resistance or resilience that (parts of) the landscape system shows in response to induced changes.

Regarding the procedures that Landscape Character Assessment is part of, its methodology must allow for an effective and easy adoption into other policy domains. Stakeholders mentioned this as an important requirement that ELCAI should bear in mind. The lack of transparency of methods, clear criteria and agreed reference systems, seemed to have been major causes of failure of implementation in the past.

Finally, policy goals at any level within a particular sector refer to each other. European, national or federal, regional and local goals are linked. For landscape policy and the corresponding landscape information, this sets conditions to the ability of up- and down-scaling of that landscape information. Stakeholders were looking for methodologies that take these considerations into account.

7 Current applications and future perspectives of Landscape Character Assessments

Dirk M. Wascher

7.1 Introduction

In Europe over the last five years, "landscape character" has received increasing attention from policy makers and researchers at both the national and international level. Growing demand for landscape expertise can be recognised on the side of political institutions such as the European Commission, the Council of Europe (European Landscape Convention), the Organisation for Economic Co-operation and Development (OECD) and UNESCO as well as on the side of NGOs such as the European Centre for Nature Conservation (ECNC). These interests appear to reflect a newly and more widely experienced awareness regarding landscape functions and values. The launching of the European Landscape Convention (Council of Europe) developing national landscape research programmes and the increasing role of landscape research for indicator-based monitoring and reporting in support of – e.g. agri-environmental – policies are unmistakable signs that the demand for landscape expertise is real and is here to stay.

Because the majority of existing regional and national concepts differ in terms of objectives and methodologies, there is a need for a common framework. The most important factors in such a framework are biogeographic parameters, land use data and information or farming systems recognised at the international level. This information can be used to produce agricultural landscape units at the European level, i.e. areas of relative uniformity. The international information layers will need verification by national and regional experts to ensure that existing information is taken into account before generic landscape types are defined. The landscape concept foresees the development of a spatial reference base in which the agricultural landscape units are broadly differentiated according to actual and potential land use intensity. In order to assess levels of sustainability of the countryside, two main streams of indicators should be developed in parallel: (1) those deriving from harmonised and strongly aggregated European data set, and (2) those relating to the regional conditions and the farm level. Depending on the landscape unit in question, indicator sets can vary in their composition and number.

An indicator-based monitoring of European agricultural policy implementation at the landscape level should address the following aspects:

- Europe's high quality resources in terms of soil quality, water quantity and availability, biological and landscape diversity as a pre-condition for sustainable agriculture;
- environmentally sensitive areas are playing are of priority importance for policy makers in their effort to identify and target adequate actions;
- regional differentiation will help to better target the implementation existing and future agri-environmental policies;
- agri-environmental issues require a high level of cross-sectoral co-operation in order to meet the wide scope of environmental and socio-economic challenges; and
- existing European agri-environmental policies require a high level of reliability when building upon exiting information in order to specify implementation targets and technical references.

Because of its over-arching character, the landscape character approach should be further explored regarding its capacity to meet the above objectives.

Recent research and policy initiatives have demonstrated that European Landscape Map – LANMAP2 – already provides a wide range application fields for European projects and policy initiatives, such as:

- for ELCAI (The European Landscape Character Initiative): as a framework for further integrating national and regional approaches to Landscape Character Assessment at the European level;
- for ENRISK (explanation of abbreviation): as the basis for developing landscape indicators for an Environmental Risk Assessment of Agriculture in Europe;
- for BIOPRESS: as spatial reference base for measuring pressures on biodiversity;
- for SENSOR: integration of landscape character when developing a regional reference framework for sustainability impact analysis; and
- for the European Landscape Convention: identification of trans-frontier landscapes as well as everyday landscapes under the Convention.

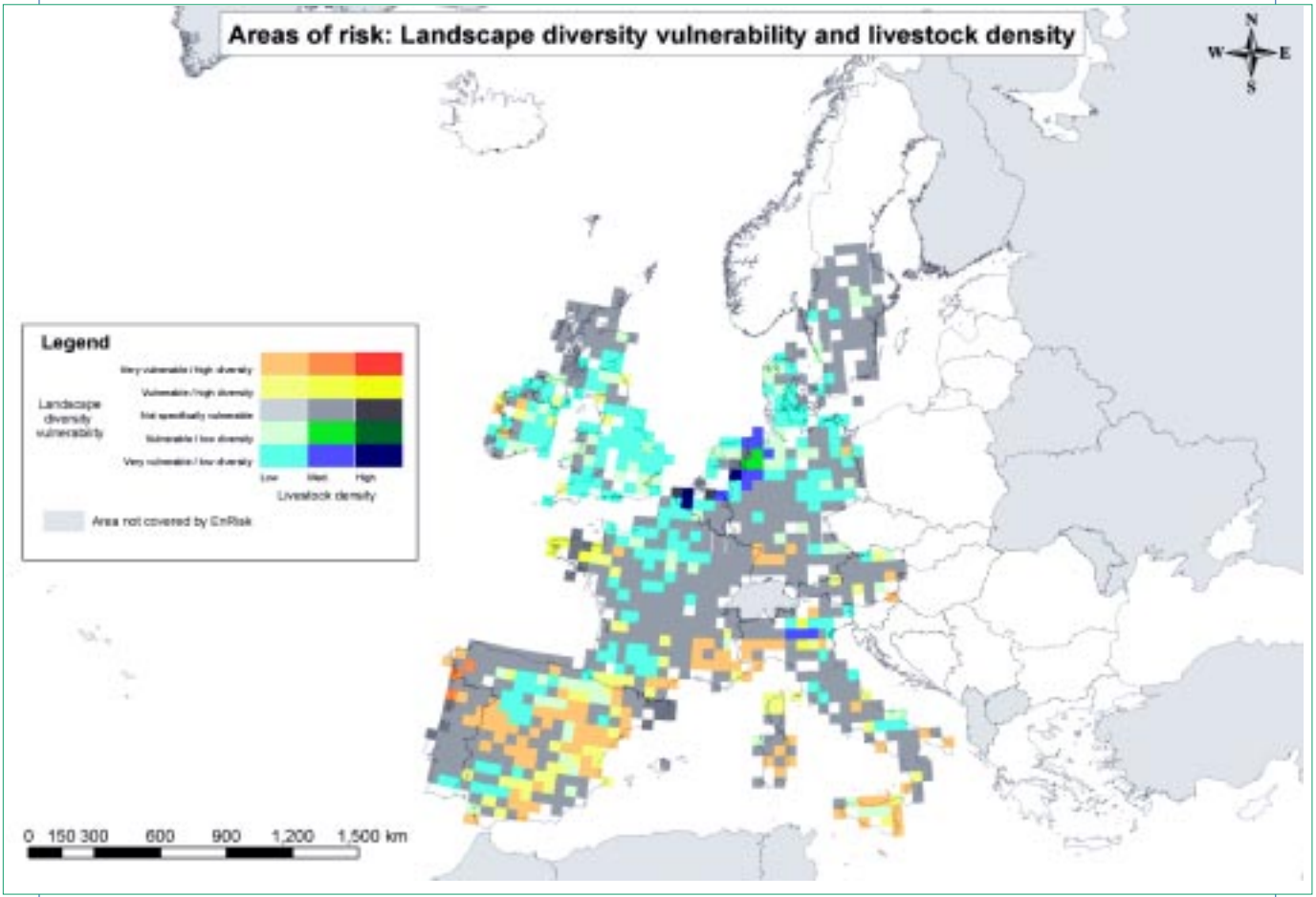
This chapter draws largely upon final reports and other deliverables resulting from the above mentioned European projects as well as from the recently published ELCAI policy brochure (Pérez-Soba and Wascher 2005).

7.2 Current applications

7.2.1 Landscape Risk Assessment as part of the EnRisk project

Between 2001 and 2005 the EU Concerted Action project 'Environmental Risk Assessment for European Agriculture' (EnRisk) has been implemented under the co-ordination of the European Centre for Nature Conservation. Funded under the '5th Framework', EnRisk was actually a direct follow-up project from the ELISA project on developing agri-environmental indicators at the European level in response to OECD requirements (Wascher 2000). The key indicators

MAP 7.1. Landscape diversity, vulnerability and livestock density. (Source: Delbaere and Nieto Serradilla 2005)



identified in ELISA were in fact landscape coherence, landscape diversity and landscape openness.

The reasons for selecting landscape diversity as an application were:

- landscape diversity appears a more commonly recognised attribute throughout the whole of Europe;
- landscape diversity has clear policy support, e.g. in the Pan-European Biological and Landscape Diversity Strategy (Council of Europe *et al*.1995), but also the European Landscape Convention (Council of Europe 2000);
- current landscape indicator developments by the European Commission (IRENA project) point at landscape diversity as one of the key policy issues; and
- the case study examples that have been chosen in support for the European risk assessment are also addressing issues of landscape diversity.

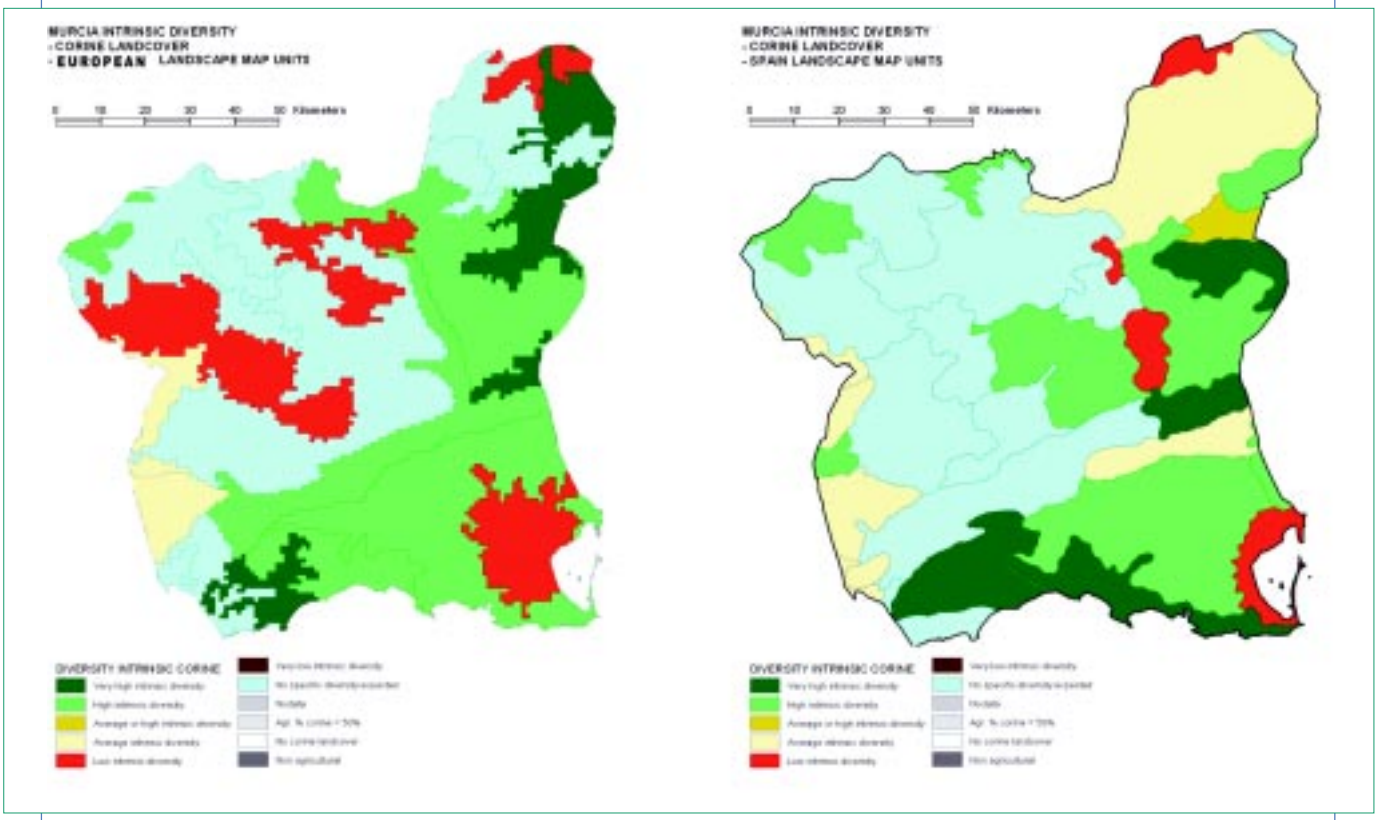
In the absence of clearly defined parameters for landscape vulnerability, it was considered as a useful approach to interpret the presence of highly extreme levels of landscape diversity – deriving from high scores of both Shannon and intrinsic diversity within the same landscape type – as a possible indication for 'landscape diversity vulnerability'. In concrete terms, this means that LANMAP landscape units where very high or very low Shannon diversity is confirmed by equally high or equally low levels of intrinsic diversity are considered as being vulnerable against certain agricultural land use changes. This is certainly true in European lowland regions where certain large-scale pasture farming must be considered as the adequate and often traditional land use type. In such areas, a diversification of land use would most likely result in the loss of land use values that are relevant in the eyes of the regional stakeholders and policy makers. The two case studies in the Green Heart of Holland (The Netherlands) and in Murcia (Spain) are useful examples for illustrating these two principle trends.

The analysis of the region's intrinsic diversity (Figure 4) based on Corine land cover types demonstrates some clear differences with the structural diversity as identified by the Shannon index. Data used for these calculations is Corine data from a period before the major changes took place (ca. 1990–1995). While the European data implies larger proportions of low intrinsic diversity areas in north-eastern part of the region and at the coast, both maps show average or non-specific intrinsic diversity for most of the northern and eastern zones.

7.2.2 Transboundary assessments

LANMAP2 can be used in the initial phase of a Landscape Character Assessment, in order to facilitate the analyses of the structure and pattern of the landscape. For example, LANMAP2 has been recently

FIGURE 7.1. Intrinsic diversity European (left) and Spanish (right) landscape maps.



applied in the comparative study of the transfrontier National Parks of Arribes del Duero (Salamanca, Spain) and Douro Internacional (Portugal). Legend categories of LANMAP2 were used to examine the landscape composition at high scale, which allowed the stratification of the territory in landscape types and consequent selection of homogeneous sampling units. The whole study area belonged to the type of Mediterranean mountains (altitude range from 500 to 1,500 m) with rock as dominant parent material, and with three different land cover classes, i.e arable land, heterogeneous agricultural areas, and shrubs and herbaceous vegetation (see Figure 7.3). These categories were taken into consideration to delimit the homogeneous zones, which were then characterised by the dominancy of one land cover or the mix between two of them. In this specific transfrontier landscape, the river Duero is the natural boundary between the National Parks. Therefore, the hydrological network is a very relevant characteristic that was also considered as an addition to LANMAP2.

The availability of LANMAP2 facilitated this comparative study because it allowed integrating the existing landscape typologies from Spain and Portugal which differ in terms of methodology, data and the conceptualisation of landscape. The experience demonstrated that LANMAP2 can provide useful initial baseline data for the identification of dominant structural landscape aspects. Integrating local and regional expert knowledge into such an overarching European framework offers the opportunity to link assessments at the international level and to improve the accessibility of regional information for European decision making processes.

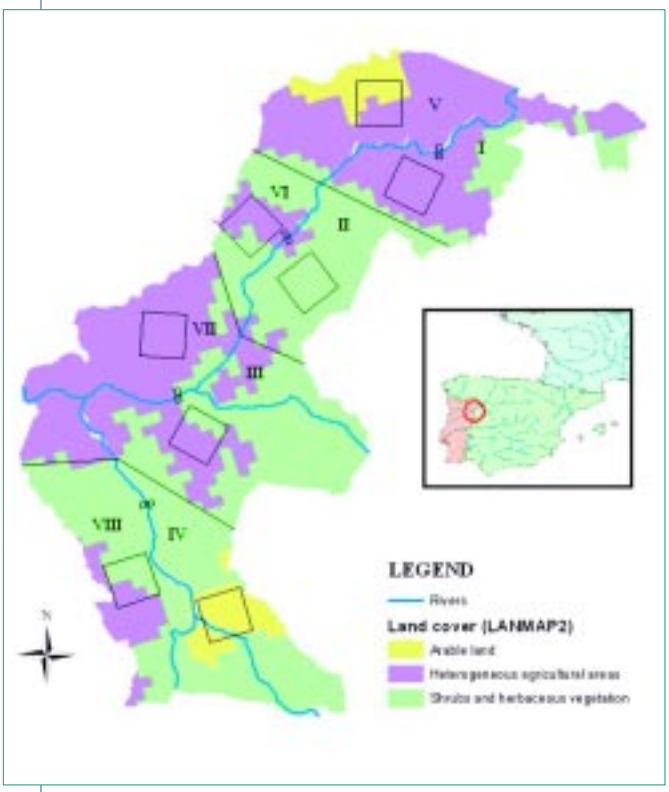
7.2.3 Sustainability impact assessment at the regional level

Sustainability of land use in European regions is a central point of policy and management decisions at different levels of governance. Implementation of European policies designed to promote and protect multifunctional land use requires the urgent development of robust tools for the assessment of different scenarios' impacts on the environmental and socio-economic sustainability. The objective of Integrated Project SENSOR[1] (www.sensor-ip.org) is to build, validate and implement sustainability impact assessment tools (SIAT), including databases and spatial reference frameworks for the analysis of land and human resources in the context of agricultural, regional and environmental policies. One focus will be on assessing risks and sustainability thresholds at the regional level by making use of LANMAP as one of the spatial reference framework components.

The development of a SENSOR regional profile is based on existing European standards as the NUTS region code, the CORINE Land cover information and the ESPON socio-economic approaches based on Eurostat data. The deliverable 3.1.3. is hence directly based on other SENSOR Module 3 deliverables such as the socio-economic profiles developed in 3.1.1, and on LANMAP,

1 SENSOR = Sustainability Impact Assessment: Tools for Environmental, Social and Economic Effects of Multifunctional land use in European Regions

FIGURE 7.2. Use of LANMAP2 to examine landscape composition at high scale and identify homogenous sampling units.



the European typology of landscapes. The first level regional profiling is done for all NUTS regions. For this purpose a SENSOR-wide accepted NUTS-classification and NUTS-level had to be developed. Then, in the second level, a clustering of the NUTS-X regions had the aim to arrive at a total number of 30 to 40 regional clusters which are going to form the basis for developing indicator sets and thresholds for the final profiling of regions.

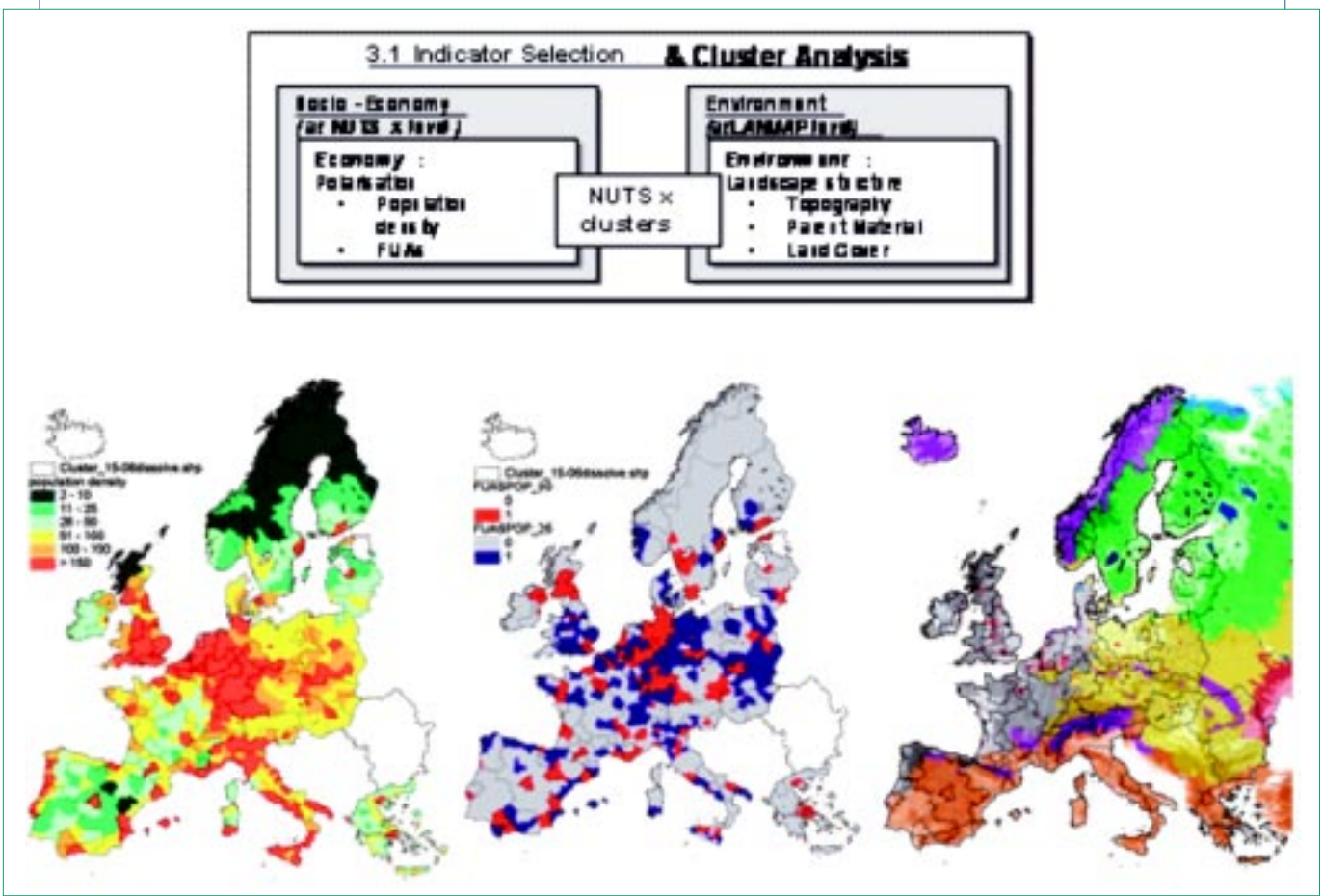
The cluster-analysis is a first step towards the profiling and indicator assessment for other activities within SENSOR.

7.3 Future perspectives

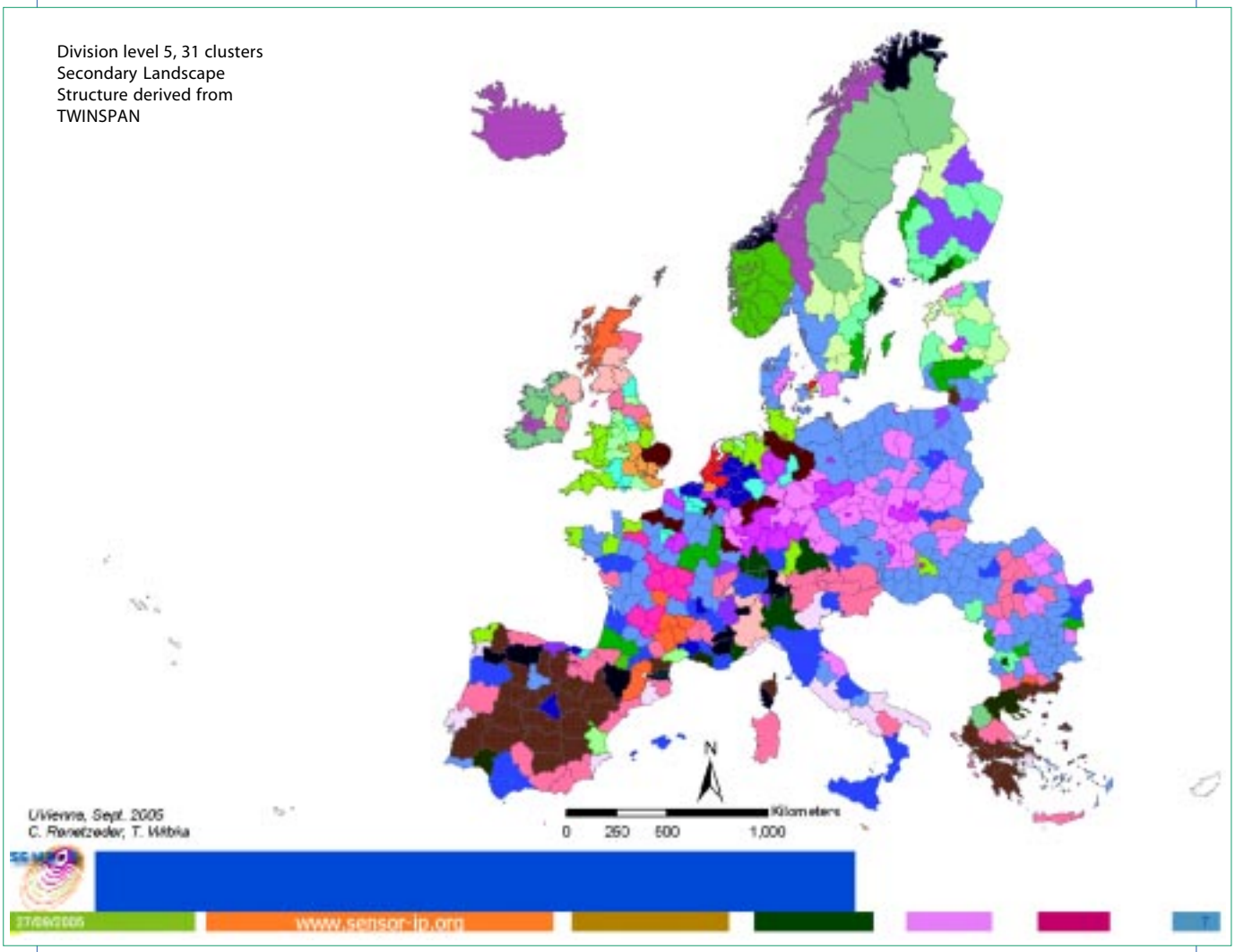
7.3.1 Towards Landscape Character Assessment guidelines

A solid body of European LCA work is now established, with its very variety providing important indicators with respect to how new LCA work can proceed. Recognition of the difference between and the significance of LCA work addressing both LC-Types and LC-Areas is a key guideline. The need for objective procedures that go beyond reliance on “expert” opinions is another strong contemporary feature in LCA work. However, over-use of GIS-based techniques to make LCA mappings in

FIGURE 7.3. Combining socio-economic (Eurostat) and landscape information (LANMAP2) for identifying regionally homogenous areas in Europe.



MAP 7.2. SENSOR Cluster Analysis (2nd draft) on the basis of LANMAP 2 and socio-economic data. (Source: University of Vienna 2005)



automated ways is also to be avoided, especially where the focus is on mapping of LC-Areas. GIS analysis and mapping followed by fieldwork and consultation based refinement could possibly be considered as the state-of-the-art. LC-Types may be mapped on the basis of mainly biophysical factors or a mixture of these and non-biophysical aspects, but consideration of the latter is mandatory for mapping of LC-Areas. Last but not least, clear applied scope and context provides a strong basis for purposeful, widely recognised and used LCA results (Groom 2005).

7.3.2 The role of landscape character in integrated assessment of landscape

Landscape character appears as an essential element of stratification in integrated spatial analysis. Landscape character should be used for sampling natural data (e.g. species) as well as re-sampling economic and social statistics in a coherent way. This approach improves (a) the interpretation of indicators of spatial interactions and landscape based modelling, and (b) the communication with a range of users, by combining environmental change with landscape characters, which is more meaningful. The various levels of policy making are in a better position for interpreting a range of indicators in their context. The upper levels can improve their understanding of spatial differences and specificities. The local levels are able to translate European or national signals in their own environment of decision making. As well, local authorities will be in a better position for co-operating for the solution of common problems (Weber 2005).

On the basis of the European wide Corine land cover (CLC) programme carried out in 1990 and 2000 for more than 25 countries, the EEA is developing land use and ecosystem accounts (Weber, 2005). Changes are accounted for in two joint perspectives:

- Land use functions of landscapes, where emphasis is put on housing, transport, food supply, energy supply, tourism ... In addition to land cover change accounts, land use accounts present tables computed from conventional demographic, social and economic statistics. Spatial disaggregation of these statistics down to the very local level of interactions is the main difficulty.
- Ecosystems state, where quantitative accounts derived from land cover maps are combined with

tables on ecosystem health or distress, ecosystem wealth (the natural capital) and ecosystem services. Integration of in situ monitoring is the challenge for ecosystem accounting.

7.3.3 The further development of LANMAP

Already in its current state LANMAP2 provides a wealth of information on the distribution and character of different landscape areas in Europe. However, rather than treating LANMAP2 as a static and finalised map product, it should be considered as a "living reference base" that will be updated and further developed according to the ongoing developments in European data management and technology. One of the priority tasks for coming years will be to integrate region-specific data on cultural heritage and to populate the LANMAP database with existing European environmental information (e.g. soil types, potential natural vegetation, species information). Another important factor in the further development of LANMAP2 is the role of changing policy needs expressed by national and regional stakeholders. Policy data such as on protected area schemes and landscape legislation is already now available at the European level and will be included. With regard to the overall update frequency of LANMAP, it is envisioned to take into account the renewal sequence of the CORINE Land Cover data (currently a 10-year period), managed by the Joint Research Centre and the European Environment Agency. This way, the LANMAP of the future will incorporate land cover changes and provide the basis for landscape monitoring (Mücher *et al.* 2005).

7.3.4 ELCAI and the European Landscape Convention

For the purposes of the Convention "'landscape' means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors". The Convention states in Article 6 devoted to "Specific measures" the following provisions:

C) Identification and assessment

1. With the active participation of the interested parties,..., and with a view to improving knowledge of its landscapes, each Party undertakes:
   a.i) to identify its own landscapes throughout its territory;
   a.ii) to analyse their characteristics and the forces and pressures transforming them;
   a.iii) to take note of changes;
   b) to assess the landscapes thus identified, taking into account the particular values assigned to them by the interested parties and the population concerned.
2. These identification and assessment procedures shall be guided by the exchanges of experience and methodology, organised between the Parties at European level ...

D) Landscape quality objectives

Each Party undertakes to define landscape quality objectives for the landscapes identified and assessed, after public consultation ...

E) Implementation

To put landscape policies into effect, each Party undertakes to introduce instruments aimed at protecting, managing and/or planning the landscape."

In order to explain the scope of this Article, a report was prepared in the framework of the Working Programme of the Convention, on "Identification and assessment of the landscape and landscape quality objectives, using cultural and natural resources" and presented on 28 and 29 November 2002, at the second Conference of Contracting and Signatory States to the European Landscape Convention.

The report describes the political framework within which the implementation of the Convention is being applied and cites the thoughts that have been put forward regarding terms of landscape identification and assessment, and the formulation of landscape quality objectives. It consider that for several decades now, the identification and assessment of landscapes, and the formulation of landscape quality objectives have been included among the tasks that public authorities have set themselves within the framework of landscape protection policies and, more recently, within the framework of land management policies. The European Landscape Character Assessment Initiative (ELCAI) of Landscape Europe represents a main contribution for the development of the research on the appropriate implementation of the European Landscape Convention (Déjeant-Pons 2005).

7.3.5 Agri-environmental indicators

In November 1999 the Agriculture Council adopted a strategy to address the integration of environmental requirements into the Common Agricultural Policy (CAP) through the reforms adopted under Agenda 2000.

Objectives were set for water, agri-chemicals, land use and soil, climate change and air quality, and landscape and biodiversity (CEC 2001). Detailed policy objectives have to be set and progress in reaching these objectives measured. According to the European Commission, a solid set of indicators is needed:

- to help monitor and assess agri-environmental policies and programmes, and to provide contextual information for rural development in general;
- to identify environmental issues related to European agriculture;
- to help target programmes that address agri-environmental issues; and
- to understand the linkages between agricultural practices and the environment.

The work of the Commission services is developed from that of the OECD, adapting and extending it to cover the European Agricultural system. The Commission's work goes further in trying to define not only the necessary indicators, but also methodologies to be applied, and possible data sources or data collection methods, so that indicators for EU Member States are harmonised and comparable. As part of the implementation, the European Environment Agency has

launched the IRENA project on the development of EU agri-environmental indicators. Within the list of 35 agri-environmental indicators proposed by COM(2001)144 the ones that are related to landscape character are listed in Table 7.1.

During an IRENA expert meeting in Copenhagen (EEA 2003), the indicators No. 32 'Landscape state' and No. 35 'Impact on landscape diversity' had been discussed and the following future needs were identified:

- Conceptual aspects still need to be agreed upon to develop Landscape state and Impact on landscape diversity indicators.
- A European landscape typology is needed to assess landscape indicators;
- Alterra is in the process of developing a European wide landscape typology in consultation with MS;
- The proposal for IRENA is to combine the Alterra approach with other data sets related to agricultural holdings and cultural attributes;
- Landscape indicators such as parcel size, linear features and crop variation were identified as meaningful landscape descriptors, which could be used in combination with a landscape typology.

TABLE 7.1. IRENA agri-environmental indicators relevant for landscape character.

DPISR	IRENA indicators
Responses	No. 1. Area under agri-environment support No. 4. Area under nature protection
Driving factors	No. 12. Topological change
Pressures	No. 24. Land cover change No.26. High nature value (farming) areas
State	No. 32. Landscape state
Impact	No. 35. Impact on landscape diversity

- Data sets proposed – CLC 1990 and 2000, LUCAS 2001 and 2003 (but only at EU level), and FSS data (but data is not detailed enough for landscape analysis).
- Parcel sizes could be extracted from the IACS Land Parcel Identification System, but only on a case study basis. LUCAS is the only source of data for linear features, but sampling rate is insufficient. FSS could provide information on crop variation.

Annex I
The questionnaire used to gather data on LCA examples from ELCAI project partners

ELCAI – Landscape Character Assessment Checklist

- please refer to the Guidance Notes at the end of the checklist
- also refer to the files <<ELCAI_May03_ToR.doc>> and <<ELCAI_LCAdef.doc>>

- underlined = important information to provide
  ELCAI Project partner:
  Short title of LCA example:
  Type:
  ( ) Generic classifications or typologies
  ( ) Unique area descriptions
  ( ) other:

ELCAI – Landscape Character Assessment Checklist.

	short answer	long answer/comments
GENERAL INFORMATION		
Full title of this LCA example		
Context / Purpose of this LCA example		
Technical status		
– *starting / concept phase*		years:
– *pilot*		years:
– *advanced*		years:
– *finalised*		years:
Operational status		
– *scientific usage*		example(s):
– *policy usage*		example(s):
– *for monitoring / reporting*		example(s):
– *other usage (e.g. for EIA)*		example(s):
Date of release (if any)		
Lead organisation responsible for making this LCA		
– contact person		
Reference paper(s), reports(s)		
– web–link		web URL:
Geographic scope		
– current development of this LCA example		
– *national*		details:
– *regional*		details:
– *local*		details:
– *other*		details:
– intended application of this LCA example		
– *national*		details:
– *regional*		details:
– *local*		details:
– *other*		details:
Temporal representation		
– *previous conditions*		details:
– *the current situation*		details:
– *future scenarios*		details:
– *other*		
Product		
– *map*		details:
– *written descriptions*		details:
– *visualisations*		details:
– *other*		details:

ELCAI – Landscape Character Assessment Checklist, continued.

	short answer	long answer/comments
KEY DEFINING CRITERIA		
ñ bio–physical (e.g. climate, soils geomorphology, vegetation, etc.)		details:
ñ cultural (e.g. land use, social/econ factors, historical development, etc.)		details:
ñ aesthetics (e.g. spirituality, beauty)		details:
ñ stakeholder knowledge (e.g. experts, public, policy customers)		details:
ñ other		details:
METHODOLOGY		
ñ landscape character element set ñ *single level*		number of elements:
ñ *hierarchical*		number of levels (and number of associated elements):
ñ list of landscape character elements		details (or a separate file):
ñ LCA method		details:
LANDSCAPE INDICATORS Have landscape indicators been identified associated with this LCA example? Types of indicators: ñ *Structural*		number:
		example(s):
ñ *Functional*		number:
		example(s):
ñ *Management*		number:
		example(s):
ñ *Value*		number:
		example(s):
ñ *Driver*		number:
		example(s):
ñ *Pressures*		number:
		example(s):
ñ *State*		number:
		example(s):
ñ *Impact*		number:
		example(s):
ñ *Response*		number:
		example(s):
Are these indicators used to make the LCA?		details:
LANDSCAPE MAPS		
Scale:		
Digital or analogue:		
Projection:		
Availability:		
Data format:		

ELCAI – Landscape Character Assessment checklist – Guidance Notes

GENERAL INFORMATION

Type:
Indicate with an "X" whether the LCA example is one resulting in generic character types of unique character types – refer to <<ELCAI_LCAdef.doc>> for explanation of this difference. If neither of these options is appropriate mark 'other' and explain.

Context:
Under this heading please explain the situation that gave rise to the LCA example. This may also be used to provide information on the purpose of the LCA example being described. For example, it may be associated with a national programme for landscape definition. Or, it may have been a thesis project for a Masters or PhD student. Or, it may have been related to some specific piece of policy or planning work, such as agricultural subsidy reform or organisation of tourism development; etc. Please use up to about 100 words.

Technical Status:
Please specify the years when the major phases of the work (conceptual / pilot / advanced development / finalisation) were or are likely to be completed.

Geographic scope:
This is seeking to find out the geographic extent that the LCA, either a generic or unique areas LCA, is designed for or has been applied upon. This is not therefore seeking information about the "grain size", i.e. mapping scale or minimum size of the mapped units. For example, if an example produces landscape character units down to a size of 100 km square, but does this for the whole of a country the answer to this question is "national", not "local". (Information on the grain size is asked for later, under "landscape maps".) Please mark an "X" for which of the four levels is/are appropriate for this LCA example. Details of the specific geographic extent can be given in the right-hand column. The response "other" might be used if the extent of the LCA is national, but only for certain parts of the national extent, such as only areas that are seen as forming the agricultural part of the country. This part of the questionnaire is split into two parts. The first part is asking about the geographic scope of existing work on this LCA example, such as in its development stage. The second is asking about the geographic scope that it is planned that the LCA should one day be applied across.

Temporal representation:
This relates to the point/period in time that the LCA example relates to, such as the past, present or future. The response "other" might be used for example if the LCA example represents a mixture of past, present and future situations, but please provide explanation in this case.

Product: Map:
I.E. an actual map, either analogue or digital, of Landscape Character Assessment areas.

Product: Visualisations:
i.e. graphical illustrations, either analogue or digital, of Landscape Character Assessment areas, e.g. artist's perceptions of typical examples of the Landscape Character Types or photos or drawings/paintings of actual Landscape Character Areas.

KEY DEFINING PARAMETERS:
This asks for information on what parameters were/are used to make this LCA example function. Please mark an "X" for whichever of the three categories are appropriate and provide a list of the actual parameters used or other details in the right-hand column.

METHODOLOGY:
Please provide meta-information on the set of landscape character elements that are associated with this LCA example, such as the number of elements and whether they are arranged hierarchically. Please also provide a list of the elements, either within the questionnaire or as a separate file – this list need not necessarily be in English.

Please use up to about 200 words to explain the basic methodology used to make this example of LCA. For example, information concerning whether the methodology is interpretative or analytical, and its use of statistical and classificatory procedures, etc.

LANDSCAPE INDICATORS:
The aim of this section is to identify some of the ways in which indicator-work interfaces with LCA-work, in order to start development of the WP5 (Indicators) in the ELCAI project. The intention here therefore is to gather information on indicators that relate to specific examples of LCA. So, please use this section ONLY for indicators that are explicitly associated with the LCA example being described in the checklist. It may be therefore that in some cases it is appropriate to leave this section uncompleted.

Type of indicator:
Structural / Functional / Management / Value: These refer to the Indicator typology developed from the OECD Oslo 2002 indicators workshop (November 2002). Structural indicators describe the stock or condition of landscape elements (e.g. woodland cover; woodland fragmentation). Functional indicators concern landscape processes or outputs (e.g. species richness; recreational use). Management indicators concern the response to landscape issues (e.g. number of agri-environmental agreements; area of land designated for landscape protection). Value indicators deal with aspects of landscape quality, such as its aesthetic qualities, or tranquillity or rural areas).

The older, OECD DPSIR typology for indicators, is generally more widely understood. Driving forces are those such as policy or economic conditions which trigger change. Pressures are the more direct factors that impact on landscape as a result of the various drivers (e.g. land abandonment; agricultural intensification). State indicators are more or less equivalent to the structural indicators described above

(e.g. woodland cover). Impact indicators cover the consequences of changes in the drivers or pressures (e.g. loss of biodiversity). Response indicators set out the management response (e.g. number of management agreements).

Are these indicators used to make the LCA?
If "no" then it is implied that the association of these indicators to the LCA is through use of the LCA as a methodological basis and/or spatial basis for evaluating these indicators.

LANDSCAPE MAPS
This section relates to LCA examples that have been applied to produce actual map products of Landscape Character Areas, i.e. rather than work that aims only to define LCA types. (This information is requested in connection with ELCAI WP 4, Demonstration: European map and typology.)

Scale:
This relates to the cartographic meaning of "scale" in terms of the level of detail, rather than the reproduction scale of hard copy output. This information can be given in terms of the scale factor (such as 1:100,000) or the minimum mapping unit size (e.g. 10,000 ha).
N.B. if giving the MMU size, please specify in hectares, to avoid confusion between "km squared" and "square km".

Availability:
Whether the map product is controlled by copyright, can be licensed or purchased, or is public domain. How easy is it to access or acquire. Who controls the rights and availability.

Data Format:
For example: vector, raster; e00 (ESRI export), ArcView shape, etc.

Annex II
Landscape types of the European landscape by country

All Tables source: European landscape typology map (LANMAP2)

TABLE II.1. Landscape types of the European landscape typology for Austria.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Chr_af	0.0	0.00
2	1	Zms_op	0.4	0.00
3	2	Zmr_al	0.7	0.00
4	2	Zms_al	2.2	0.00
5	2	Cho_al	16.1	0.02
6	7	Cmr_al	20.4	0.02
7	1	Chs_we	30.5	0.04
8	1	Mhs_al	58.1	0.07
9	1	Cho_we	141.6	0.17
10	1	Chr_fo	151.0	0.18
11	1	Chr_pa	154.0	0.18
12	1	Mhr_fo	174.7	0.21
13	3	WABOD	177.5	0.21
14	1	Mhr_al	317.5	0.38
15	6	URBAN	470.2	0.56
16	1	Zms_pa	471.0	0.56
17	3	Cmr_pa	554.7	0.66
18	8	Cms_ha	1119.0	1.33
19	1	Mhs_ha	1467.3	1.75
20	3	Zmr_pa	1737.0	2.07
21	5	Mhs_fo	1740.2	2.07
22	18	Znr_op	1952.4	2.33
23	16	Cms_pa	2082.8	2.48
24	5	Chr_al	2145.7	2.56
25	24	Chs_fo	2328.8	2.77
26	4	Zar_op	2341.0	2.79
27	2	Chr_ha	2699.9	3.22
28	4	Cmr_ha	2917.3	3.47
29	9	Znr_sh	3287.2	3.91
30	4	Cms_fo	3402.8	4.05
31	8	Chs_ha	3405.6	4.06
32	19	Znr_fo	8934.7	10.64
33	62	Chs_al	10747.9	12.80
34	21	Cmr_fo	12920.6	15.39
35	24	Zmr_fo	16001.4	19.06
Total	272		83972.5	100.00

TABLE II.2. Landscape types of the European landscape typology for Belgium.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	4	Ahr_al	6.4	0.02
2	20	NODAT	7.4	0.02
3	1	Als_fo	19.5	0.06
4	1	Ahs_fo	39.0	0.13
5	3	Ahs_af	49.0	0.16
6	1	Chs_af	78.0	0.25
7	1	Chr_pa	125.8	0.41
8	3	Als_pa	215.8	0.70
9	5	Ahr_fo	273.6	0.89
10	3	Chs_ha	396.3	1.29
11	9	Chr_fo	661.9	2.16
12	2	Cms_fo	899.2	2.93
13	8	Als_af	1039.0	3.39
14	2	Chs_al	1058.4	3.45
15	15	Chs_pa	1444.1	4.71
16	4	Ahs_al	2482.0	8.09
17	25	Als_ha	3187.1	10.39
18	33	URBAN	4499.0	14.67
19	7	Chs_fo	6004.4	19.58
20	27	Als_al	8186.8	26.69
Total	174		30672.8	100.00

TABLE II.3. Landscape types of the European landscape typology for Switzerland.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	2	Ahs_al	0.1	0.00
2	1	Chr_fo	1.0	0.00
3	5	Mhs_ha	4.5	0.01
4	1	Chs_wa	8.1	0.02
5	16	Cms_al	12.3	0.03
6	5	Zmr_fo	21.0	0.05
7	29	Cmr_pa	29.2	0.07
8	2	Chr_af	36.0	0.09
9	1	Cho_fo	63.0	0.15
10	3	Ahr_ha	70.3	0.17
11	3	Chs_af	82.0	0.20
12	15	Znr_sh	96.0	0.23
13	17	Chs_ha	109.5	0.27
14	2	Mmr_op	125.7	0.30
15	19	Zar_op	135.5	0.33
16	10	Ahs_ha	167.4	0.41
17	1	Chs_fo	182.2	0.44
18	1	Cmr_ha	199.0	0.48
19	5	URBAN	242.1	0.59
20	10	Ahr_fo	309.0	0.75
21	31	Znr_fo	420.0	1.02
22	78	Cmr_fo	420.1	1.02
23	2	Zms_op	524.6	1.27
24	1	Zhs_ha	670.0	1.62
25	18	Mhr_fo	793.9	1.92
26	15	WABOD	1039.4	2.52
27	2	Zmr_op	1435.0	3.48
28	2	Zax_op	1437.4	3.48
29	4	Cmr_op	1651.3	4.00
30	2	Cms_op	1897.8	4.60
31	23	Cms_ha	11444.6	27.73
32	10	Znr_op	17641.6	42.75
Total	336		41269.5	100.00

TABLE II.4. Landscape types of the European landscape typology for the Czech Republic.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	WABOD	13.0	0.02
2	5	Chr_ha	65.9	0.08
3	2	Zmr_pa	69.0	0.09
4	7	Cms_ha	158.3	0.20
5	5	Zhs_al	258.0	0.33
6	3	Zms_al	422.8	0.54
7	1	Cms_al	432.0	0.55
8	13	Cmr_ha	477.9	0.61
9	1	Zms_fo	520.0	0.66
10	19	URBAN	1054.0	1.34
11	5	Chs_fo	1526.0	1.93
12	15	Zhr_al	2190.3	2.78
13	4	Zmr_al	2621.9	3.32
14	24	Zmr_fo	4141.7	5.25
15	25	Chr_fo	5961.2	7.56
16	46	Cmr_fo	6124.7	7.77
17	11	Cmr_al	8736.1	11.08
18	19	Chr_al	21936.0	27.81
19	67	Chs_al	22164.1	28.10
Total	273		78872.9	100.00

Two landscape types are the dominant ones: Chs_al (**C**ontinental **h**ills dominated by **s**ediments and **a**rable **l**and) with an area of 22164.1 km² (67 polygons) covering 28.1% of the country, and Chr_al (**C**ontinental **h**ills dominated by **r**ocks and **a**rable **l**and) with 21936.0 km² and a share of 27.8 km². Each of the other 17 landscape types has a share less than 12%.

TABLE II.5. Landscape types of the European landscape typology for Germany.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Clo_af	1.0	0.00
2	7	Cms_op	2.3	0.00
3	2	Chs_wa	4.9	0.00
4	1	Chr_af	11.0	0.00
5	1	Cho_fo	13.0	0.00
6	1	Als_sh	18.3	0.01
7	5	Ahr_af	18.5	0.01
8	1	Aho_al	20.0	0.01
9	1	Cls_wa	21.0	0.01
10	1	Cmo_ha	21.0	0.01
11	1	Chs_pc	23.0	0.01
12	2	Cls_ha	23.0	0.01
13	1	Als_op	24.3	0.01
14	2	Als_af	25.0	0.01
15	2	Ahs_pc	28.0	0.01
16	1	Clr_fo	29.0	0.01
17	1	Cms_af	32.0	0.01
18	1	Alr_af	38.0	0.01
19	1	Alr_al	48.0	0.01
20	1	Clo_fo	61.0	0.02
21	4	Cls_af	61.0	0.02
22	1	Alo_we	87.0	0.02
23	3	Znr_op	87.1	0.02
24	166	FLATS	125.0	0.03
25	3	Ahs_af	134.0	0.04
26	1	Ahr_ha	174.6	0.05
27	3	Chs_af	262.0	0.07
28	1	Ams_fo	318.0	0.09
29	3	Cmo_pa	370.0	0.10
30	16	Als_ha	390.6	0.11
31	1	Cho_al	414.0	0.12
32	1	Cmr_ha	444.0	0.12
33	1	Ahs_ha	481.0	0.13
34	616	NODAT	491.1	0.14
35	1	Znr_sh	503.0	0.14
36	1	Amr_fo	676.0	0.19
37	15	WABOD	692.4	0.19
38	1	Cmr_pa	1136.3	0.32
39	3	Ahs_pa	1226.0	0.34
40	41	Cms_ha	1270.6	0.36
41	5	Alo_al	1549.7	0.43
42	10	Clo_al	1695.7	0.47
43	11	Chs_ha	1727.7	0.48
44	44	Clo_pa	1977.3	0.55
45	9	Ahs_fo	2262.0	0.63
46	3	Als_fo	2964.0	0.83
47	7	Cmr_al	3578.3	1.00
48	12	Alo_pa	3844.1	1.08
49	1	Ahr_pa	3963.0	1.11
50	10	Chr_ha	4477.0	1.25
51	8	Zmr_fo	4796.0	1.34
52	7	Cms_al	5216.7	1.46
53	28	Chs_fo	6163.2	1.72
54	7	Cms_fo	6639.9	1.86
55	26	Als_pa	7235.7	2.02
56	24	Ahr_al	10202.3	2.86
57	160	URBAN	10240.0	2.87
58	14	Cms_pa	11495.2	3.22
59	36	Cls_fo	12195.1	3.41
60	26	Ahs_al	13363.3	3.74
61	18	Cmr_fo	15186.6	4.25
62	22	Chr_fo	18951.5	5.30
63	18	Ahr_fo	22346.1	6.25
64	27	Chr_al	31678.4	8.87
65	50	Als_al	39154.3	10.96
66	70	Chs_al	45073.6	12.61
67	112	Cls_al	59548.9	16.66
Total	1681		357331.9	100.00

TABLE II.6. Landscape types of the European landscape typology for Denmark.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Alo_pa	0.9	0.00
2	1	Cls_wa	19.8	0.04
3	1	Clo_al	26.0	0.06
4	1	Als_we	34.0	0.08
5	1	Cls_sh	38.2	0.09
6	1	Chs_fo	64.0	0.14
7	26	FLATS	87.6	0.20
8	1	Clo_ha	92.0	0.21
9	1	Alo_al	129.0	0.29
10	16	Als_wa	134.6	0.30
11	2	Cls_fo	184.2	0.41
12	2	Als_ha	302.4	0.68
13	10	Als_sh	398.3	0.89
14	1	Als_fo	519.0	1.16
15	22	URBAN	1017.6	2.28
16	1169	NODAT	1039.5	2.32
17	5	WABOD	1313.2	2.94
18	27	Cls_al	13394.8	29.95
19	46	Als_al	25926.9	57.97
Total	1334		44721.8	100.00

According to Table 18 the Danish landscapes are determined by the following two types: Als_al (**A**tlantic **l**owland dominated by **s**ediments and **a**rable **l**and) with 25926.9 km² (46 polygons) and a share of 58%, and Cls_al (**C**ontinental **l**owland dominated by **s**ediments and **a**rable **l**and) with 13394.8 km² and a share of 30% of the country's area. Each of the other 17 landscape types covers less than 3% of the territory of Denmark.

TABLE II.7. Landscape types of the European landscape typology for Spain.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Alr_pc	11.0	0.00
2	1	Mlr_af	36.0	0.01
3	1	Mms_op	36.0	0.01
4	1	Alr_af	41.4	0.01
5	1	Alr_al	46.3	0.01
6	1	Mms_pc	52.0	0.01
7	1	Alr_pa	53.0	0.01
8	2	Mhs_sh	78.0	0.02
9	4	Mls_af	93.5	0.02
10	1	Amr_op	96.2	0.02
11	2	Mhs_wa	115.0	0.02
12	6	Zms_pa	115.7	0.02
13	8	WABOD	173.0	0.03
14	1	Mhs_fo	174.0	0.03
15	1	Ahr_al	179.0	0.04
16	1	Als_ha	195.6	0.04
17	2	Mnr_fo	215.0	0.04
18	1	Ahs_ha	240.0	0.05
19	1	Mlr_sh	287.0	0.06
20	3	Znr_op	319.3	0.06
21	1	Ahr_sh	497.0	0.10
22	3	Mls_we	561.6	0.11
23	1332	NODAT	605.2	0.12
24	2	Alr_ha	606.4	0.12
25	2	Mlr_fo	625.3	0.13
26	7	Mms_sh	652.0	0.13
27	3	Mmr_op	740.0	0.15
28	7	Mls_ha	849.6	0.17
29	2	Mmr_pa	864.0	0.17
30	6	Mms_fo	915.0	0.18
31	3	Mls_fo	995.4	0.20
32	4	Ahr_pa	1052.5	0.21
33	4	Mlr_pc	1167.9	0.23
34	1	Zmr_op	1172.0	0.24
35	40	URBAN	1314.4	0.26
36	3	Mlr_ha	1370.3	0.27
37	1	Mhs_pc	1483.1	0.30
38	2	Mls_pc	1873.7	0.38
39	8	Ahr_fo	1917.3	0.38
40	2	Mhr_op	2315.4	0.46
41	6	Amr_al	2488.7	0.50
42	5	Mnr_sh	3027.7	0.61
43	7	Mms_ha	3046.0	0.61
44	8	Mls_al	3157.7	0.63
45	5	Znr_sh	3489.1	0.70
46	11	Mlr_al	3634.2	0.73
47	13	Zmr_fo	3747.3	0.75
48	4	Mhs_ha	3923.0	0.79
49	5	Amr_fo	6195.5	1.24
50	10	Mhr_pc	6555.0	1.32
51	4	Zmr_sh	6689.0	1.34
52	3	Amr_ha	7507.0	1.51
53	12	Mmr_pc	9775.0	1.96
54	19	Mhr_fo	11344.8	2.28
55	15	Mhs_al	13601.9	2.73
56	7	Amr_sh	15168.1	3.04
57	16	Ahr_ha	17144.8	3.44
58	30	Mhr_sh	22698.5	4.55
59	22	Mms_al	24317.0	4.88
60	47	Mmr_ha	26528.2	5.32
61	37	Mhr_ha	33482.3	6.72
62	57	Mhr_al	35147.2	7.05
63	51	Mmr_fo	49718.2	9.98
64	62	Mmr_sh	70219.1	14.09
65	124	Mmr_al	91620.7	18.38
Total	2053		498361.4	100.00

TABLE II.8. Landscape types of the European landscape typology for France.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Chr_pa	0.1	0.00
2	47	Cmr_op	18.7	0.00
3	3	Zms_pa	25.3	0.00
4	1	Ahs_af	29.0	0.01
5	1	Mhs_af	29.0	0.01
6	1	Als_we	33.0	0.01
7	2	Als_af	36.0	0.01
8	1	Mls_sh	38.4	0.01
9	5	Zas_op	41.4	0.01
10	4	Cms_op	41.8	0.01
11	1	Als_wa	43.3	0.01
12	1	Amr_ha	54.0	0.01
13	2	Mhs_fo	54.0	0.01
14	1	Ahr_af	57.4	0.01
15	2	Zmr_al	61.0	0.01
16	1	Mnr_fo	62.0	0.01
17	1	Ahr_pc	63.0	0.01
18	1	Alr_we	78.1	0.01
19	2	Mms_fo	81.0	0.01
20	1	Mls_ha	85.8	0.02
21	1	Ahr_sh	92.0	0.02
22	68	FLATS	94.8	0.02
23	1	Zms_al	103.0	0.02
24	1	Alo_we	120.0	0.02
25	13	Chs_fo	165.9	0.03
26	1	Zar_op	229.0	0.04
27	1	Cms_fo	264.0	0.05
28	6	Chs_al	284.6	0.05
29	3	Alo_al	335.0	0.06
30	1	Chs_ha	362.3	0.07
31	5	Cms_ha	371.9	0.07
32	9	Mls_we	381.4	0.07
33	1	Mmr_ha	439.0	0.08
34	2	Als_pc	532.0	0.10
35	2	Mhs_pa	591.0	0.11
36	1234	NODAT	616.2	0.11
37	3	Mhs_sh	623.5	0.11
38	2	Mlr_sh	671.1	0.12
39	3	Mls_al	722.2	0.13
40	2	Zmr_sh	806.0	0.15
41	4	Mhr_pc	808.0	0.15
42	16	WABOD	942.7	0.17
43	2	Alr_fo	1372.0	0.25
44	6	Mmr_al	1585.0	0.29
45	6	Mls_pc	1799.0	0.33
46	3	Amr_fo	1844.3	0.34
47	2	Mmr_pa	2131.0	0.39
48	8	Chr_fo	2138.0	0.39
49	8	Chs_pa	2287.1	0.42
50	7	Als_pa	2799.5	0.51
51	2	Cmr_pa	2827.1	0.52
52	5	Znr_fo	3036.8	0.55
53	31	Ahs_ha	3037.6	0.55
54	4	Mlr_pc	3050.8	0.56
55	2	Amr_pa	3866.0	0.70
56	10	Mhs_ha	3895.0	0.71
57	25	Znr_op	4032.8	0.73
58	5	Alr_pa	4836.4	0.88
59	3	Mmr_sh	5348.8	0.97
60	23	Znr_sh	5679.0	1.03
61	2	Mhs_pc	5912.0	1.08
62	6	Als_ha	6368.6	1.16
63	11	Mhr_sh	6498.3	1.18
64	127	URBAN	7510.0	1.37
65	11	Mhr_ha	7850.0	1.43
66	6	Zmr_pa	8832.0	1.61
67	24	Ahs_fo	9981.0	1.82
68	6	Cmr_fo	10461.9	1.91
69	11	Mhr_al	11842.0	2.16
70	13	Mhs_al	13982.0	2.55
71	23	Als_fo	15384.0	2.80
72	16	Ahr_ha	15869.0	2.89
73	16	Mhr_fo	16268.8	2.96
74	17	Ahs_pa	18126.0	3.30
74	12	Zmr_fo	18765.0	3.42
76	40	Als_al	20700.7	3.77
77	45	Alr_ha	25949.5	4.73
78	17	Mmr_fo	27153.1	4.95
79	29	Alr_al	28521.2	5.20
80	42	Ahr_fo	30788.8	5.61
81	23	Ahr_pa	46427.3	8.46
82	66	Ahs_al	53544.7	9.76
83	70	Ahr_al	76036.9	13.85
Total	2243		548826.7	100.00

The following three landscape types are the dominant ones: Ahr_al (**A**tlantic **h**ills dominated by **r**ocks and **a**rable **l**and) with 76036.9 km² (70 polygons) with a share of 13.8 %, Ahs_al (**A**tlantic **h**ills dominated by **s**ediments and **a**rable **l**and) with 53544.7 km² (66 polygons) with a share of 9.8%, and Ahr_pa (**A**tlantic hills dominated by rocks and pastures) with 46427.3 % (23 polygons) represesenting 8.5% of the French territory. Each of the other 80 landscape types covers less than 6% of the country.

TABLE II.9. Landscape types of the European landscape typology for England.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	52	FLATS	18.4	0.01
2	1	Ahs_af	22.0	0.02
3	1	Als_op	31.4	0.02
4	16	Alr_af	47.9	0.04
5	8	Als_af	76.1	0.06
6	1	Ahr_fo	257.0	0.20
7	3	Alo_al	288.0	0.22
8	810	NODAT	370.9	0.29
9	1	Amo_sh	494.0	0.38
10	1	Ahs_fo	597.6	0.46
11	3	Als_fo	644.7	0.50
12	10	Aho_sh	825.8	0.64
13	11	Ahr_sh	2061.7	1.59
14	16	Alr_pa	2250.7	1.73
15	5	Ahr_al	3725.0	2.87
16	9	Ahs_sh	5156.4	3.97
17	119	URBAN	8450.8	6.50
18	10	Alr_al	8923.2	6.87
19	9	Ahs_al	13961.5	10.74
20	33	Ahr_pa	14555.7	11.20
21	63	Als_pa	15524.9	11.95
22	29	Ahs_pa	16301.7	12.54
23	63	Als_al	35374.3	27.22
Total	1274		129959.7	100.00

TABLE II.10. Landscape types of the European landscape typology for Hungary.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Chs_we	2.5	0.00
2	2	Mhs_ha	3.5	0.00
3	1	Chs_ha	5.0	0.01
4	1	Cls_we	41.0	0.04
5	1	Cho_pa	44.0	0.05
6	1	Cls_pa	52.0	0.06
7	1	Chs_sh	84.0	0.09
8	3	Cls_wa	102.0	0.11
9	1	Cls_ha	119.0	0.13
10	6	Chs_af	125.2	0.13
11	2	Cho_we	137.4	0.15
12	7	Cmr_fo	352.5	0.38
13	4	Cls_fo	384.0	0.41
14	7	Mhs_al	398.4	0.43
15	6	Chr_al	588.6	0.63
16	1	Chs_pa	603.0	0.65
17	2	WABOD	605.0	0.65
18	4	Clo_al	704.2	0.76
19	17	URBAN	905.1	0.97
20	7	Cls_sh	1185.0	1.27
21	5	Cho_al	1405.9	1.51
22	10	Chr_fo	2690.7	2.89
23	45	Chs_fo	10541.3	11.32
24	20	Cls_al	21519.0	23.12
25	103	Chs_al	50493.0	54.24
Total	258		93091.2	100.00

TABLE II.11. Landscape types of the European landscape typology for Ireland.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	5	Ahs_ha	3.1	0.00
2	8	FLATS	10.9	0.02
3	1	Ahr_af	12.0	0.02
4	1	Alx_wa	13.0	0.02
5	1	Als_wa	14.0	0.02
6	1	Alo_ha	19.0	0.03
7	1	Alr_fo	21.0	0.03
8	1	Ahr_al	27.0	0.04
9	7	Ahs_pa	33.8	0.05
10	6	Ahs_we	41.2	0.06
11	1	Alr_ha	88.0	0.13
12	1	Alo_we	154.0	0.22
13	1	Als_we	187.0	0.27
14	2	Ahr_fo	194.0	0.28
15	11	Alr_sh	210.4	0.30
16	3	Aho_pa	326.0	0.47
17	1	Aho_sh	344.4	0.49
18	1	Ahr_op	360.9	0.52
19	6	URBAN	382.4	0.55
20	2	Aho_we	392.0	0.56
21	9	WABOD	478.0	0.68
22	1040	NODAT	540.8	0.77
23	15	Alr_al	1381.0	1.97
24	5	Ahr_sh	1619.9	2.31
25	12	Alo_pa	2356.3	3.36
26	34	Alr_we	3026.0	4.32
27	30	Als_pa	3952.9	5.64
28	22	Ahr_we	5854.6	8.36
29	37	Ahr_pa	17920.6	25.59
30	45	Alr_pa	30063.5	42.93
Total	1310		70027.7	100.00

TABLE II.12. Landscape types of the European landscape typology for the Netherlands.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Alx_wa	13.0	0.04
2	6	Als_af	13.9	0.04
3	1	Als_wa	23.6	0.07
4	1	Als_we	24.0	0.07
5	69	FLATS	37.6	0.11
6	6	WABOD	90.0	0.26
7	4	Ahs_al	91.9	0.26
8	3	Als_sh	120.1	0.34
9	2	Alo_ha	123.0	0.35
10	415	NODAT	163.1	0.46
11	2	Cls_al	255.4	0.73
12	1	Chs_ha	311.3	0.88
13	1	Als_fo	1116.0	3.17
14	3	Alo_al	1263.3	3.59
15	39	URBAN	1569.8	4.46
16	12	Alo_pa	2198.7	6.24
17	16	Als_ha	5344.4	15.17
18	50	Als_al	8295.4	23.55
19	26	Als_pa	14165.8	40.22
Total	658		35220.3	100.00

TABLE II.13: Landscape types of the European landscape typology for Norway.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Zls_af	0.9	0.00
2	2	Zho_sh	1.9	0.00
3	2	Zms_pa	2.9	0.00
4	2	Bho_sh	9.1	0.00
5	1	Bhs_wa	15.0	0.00
6	1	Zhs_wa	19.0	0.01
7	11	Bms_pa	25.2	0.01
8	1	Zlo_sh	38.1	0.01
9	1	Zhr_al	40.0	0.01
10	1	Alo_sh	45.8	0.01
11	1	Zms_wa	57.0	0.02
12	1	Alr_sh	62.1	0.02
13	6	Zmr_fo	68.5	0.02
14	1	Ahr_al	74.0	0.02
15	11	Als_al	84.5	0.03
16	19	Zls_al	93.3	0.03
17	1	Zlr_op	117.8	0.04
18	4	Bls_sh	127.7	0.04
19	3	Zms_fo	135.4	0.04
20	6	Bmr_pa	142.6	0.04
21	18	Bls_fo	148.2	0.05
22	3	Bhr_fo	167.6	0.05
23	1	Zho_op	194.0	0.06
24	17	Als_fo	194.0	0.06
25	2	Zms_we	198.0	0.06
26	53	Zmr_pa	231.3	0.07
27	4	Als_op	288.8	0.09
28	2	Zmo_sh	293.1	0.09
29	1	Bmo_sh	294.0	0.09
30	31	Zls_op	295.7	0.09
31	1	Bms_op	312.0	0.10
32	1	Bmr_sh	314.5	0.10
33	28	Zhs_al	335.3	0.10
34	1	Cls_sh	421.4	0.13
35	7	Ahr_fo	443.5	0.14
36	20	Ahs_fo	476.7	0.15
37	15	URBAN	493.9	0.15
38	2	Bhr_sh	618.2	0.19
39	6	Zhr_fo	852.5	0.26
40	23	Als_sh	854.2	0.26
41	56	Zls_fo	911.0	0.28
42	10	Alr_op	1019.1	0.31
43	27	WABOD	1035.5	0.32
44	5	Khs_sh	1551.3	0.48
45	59	Zlr_sh	1570.7	0.48
46	24	Ams_sh	1992.0	0.61
47	16	Cls_fo	2022.1	0.62
48	18	Bls_al	2084.1	0.64
49	42	Zls_sh	2592.5	0.79
50	11	Bms_fo	3238.8	0.99
51	21	Bhs_al	4238.6	1.30
52	6588	NODAT	4671.7	1.43
53	13	Ahr_sh	4681.0	1.43
54	22	Zmr_sh	5409.3	1.66
55	5	Chs_fo	6491.1	1.99
56	9	Bhs_sh	6945.5	2.13
57	101	Zhr_sh	7185.5	2.20
58	45	Ahs_sh	7510.1	2.30
59	37	Zhs_op	7604.5	2.33
60	50	Zhr_op	10205.4	3.13
61	111	Zhs_fo	11318.8	3.47
62	67	Zms_sh	23680.7	7.25
63	64	Zmr_op	30685.9	9.40
64	57	Bhs_fo	31441.0	9.63
65	84	Zms_op	35664.0	10.92
66	9	Bms_sh	39114.0	11.98
67	400	Zhs_sh	63043.8	19.31
Total	8263		326495.5	100.00

TABLE II.14: Landscape types of the European landscape typology for Portugal.

Count	Frequency	LSTYPE	Area [km²]	Area [%]
1	1	Mls_wa	12.2	0.01
2	4	Mhs_al	20.1	0.02
3	1	Mhs_sh	30.0	0.03
4	2	Mls_ha	36.1	0.04
5	4	WABOD	56.0	0.06
6	292	NODAT	86.1	0.10
7	14	Als_we	105.7	0.12
8	1	Alr_pc	273.0	0.31
9	4	URBAN	294.3	0.33
10	2	Amr_op	301.8	0.34
11	2	Als_pc	343.5	0.39
12	14	Als_al	665.4	0.75
13	3	Mlr_al	668.8	0.75
14	1	Ahr_pc	700.7	0.79
15	2	Als_fo	800.6	0.90
16	4	Mls_al	805.0	0.91
17	4	Mmr_al	855.3	0.96
18	2	Amr_al	859.3	0.97
19	4	Mhr_pc	1200.4	1.35
20	4	Ahr_ha	1611.6	1.81
21	3	Mls_fo	1653.5	1.86
22	2	Alr_ha	1732.4	1.95
23	14	Mmr_sh	1914.9	2.15
24	5	Mhr_sh	1963.5	2.21
25	4	Mlr_ha	2177.7	2.45
26	4	Als_ha	2253.6	2.54
27	16	Amr_sh	4209.7	4.74
28	2	Amr_fo	4247.4	4.78
29	22	Mhr_ha	6788.5	7.64
30	7	Mhr_fo	7901.1	8.89
31	2	Mhs_fo	8663.8	9.75
32	5	Mmr_ha	9916.1	11.16
33	6	Ahr_fo	11091.4	12.48
34	19	Mhr_al	14619.8	16.45
Total	476		88859.3	100.00

Annex III
Questionnaire of WP4 for evaluating status and development options of the European Landscape Typology Map (LANMAP2)

A need for a European-wide landscape classification and typology of landscape units is indisputable with the rationalé for this given by the overall ELCAI approach.

The European landscape classification and map produced by Alterra is a useful base for a European landscape classification and typology and represents a new computer based approach (C.A. Mücher *et al*: Identification and Characterisation of Environments and Landscapes in Europe. Alterra-Report 832, Wageningen 2003).

By means of the following questions comments concerning the selected input data layers, used methods, spatial accuracy, transparency, and acceptance necessary corrections and improvements are expected.

Please answer the questions with crosses (yes/no/partly) and in concise words only. When comparing to the national approaches use the printed Pan-European Landscape Map of Alterra (LANMAP2) in combination with the national subset of the map. ELCAI Project Partner: _____

Basic evaluation

1. Does the European landscape classification and map capture essential components of the landscape at the European level as defined in ELCAI?
- Yes
- No
- Partly

Please, provide reasons in bullet points:

2. Should further components (e.g. hydrological, biotic, and non-biophysical) be integrated into such a classification?
- Yes
- No
- Partly

Please, provide reasons in bullet points:

3. Do you accept the cartographic representation of the landscape typology?
- Yes
- No
- Partly

Please, provide reasons in bullet points:

4. For what purposes is the LANMAP2 suitable? Give some example please (e.g. assessment of suitability for cultivation, recreation, erosion hazard, ...).
- Purpose type A:
- Purpose type B:
- Purpose type C:

Principle assessment on basis of national data sets

5. When comparing the European classification and map with your national/regional approach(es), which differences need to be considered the most relevant?

a. Scale
b. Typology criteria
c. Number of types
d. Location of units (unit boundaries)
e. Source data
f. Method/Aggregation that has been applied

Please, provide short reasons in bullet points:

5e. When critically comparing the quality of the source data in the European results with your national information, which type of problem do you encounter?
- No problem
- Minor problems, can be solved with some targeted GIS-surgery;
- Moderate problems, will require some re-classifications;
- Major problems, will require substantial corrections;
- Unsolvable problems

Please, provide short reasons in bullet points:
Please, suggest a practical solution:

5f. When critically comparing the method/aggregation of data in the European results with your national information, which type of problem do you encounter?
- No problem
- Minor problems, can be solved with some targeted GIS-surgery;
- Moderate problems, will require some re-classifications;
- Major problems, will require substantial corrections;
- Unsolvable problems.

Please, provide short reasons in bullet points:
Please, suggest a practical solution:

6. Do the identified European landscape types in general reflect your national situation? Give some examples please.
- Yes
- No
- Partly

Give some examples please:

Specific assessments and suggestions

7. Please specify the location of at least two regional characteristics/ attributes for selected Landscape Units in your country that should be identified and inventoried in a European map. Please provide five examples for each attribute.
- Regional Attribute 1:
- Regional Attribute 2:
- Regional Attribute 3:

8. Please specify – if necessary – where (minor) cartographic changes or manipulations can correct false results in the European map (e.g. closing of opening of polygons to connect or separate areas that are considered to the same or distinct).
- Change 1:
  - Suggestion:
  - Reason/objective
- Change 2:
  - Suggestion:
  - Reason/objective
- Change 3:
  - Suggestion:
  - Reason/objective

9. Is it necessary to integrate more interactive (expert) knowledge/interpretation into the landscape classification and typology?
- Yes
- No
- Partly

Give some examples please:

Annex IV
National landscape policy review

IV.1 Examples for the use of LCA

In order to illustrate the connection between the policy objectives and the purposes in the use of LCA, examples of the participating countries have been selected. The following examples are classified according to the sector.

Agriculture

Austria: *Monitoring/evaluation of agro-environmental programme*
Almost every Austrian farmer is supported by the Austrian agro-environmental scheme. But there is little evidence for the intended positive influence of the financial support for so-called environmentally friendly farming. As Austria has to report to the European Commission on the performance of the Austrian agro-environmental programme in the course of a so-called midterm evaluation the exemplified study was conducted. In a representative set of landscapes, which have been selected by their degree of membership to a certain landscape type, investigations on biodiversity and landscape structure have been conducted during a field survey. The study will be finished in April 2004, an interim report is presented to the European Commission in December 2003. LCA was used as a spatial reference unit for the field survey but will also be used as a reference frame for the biodiversity assessment.

Norway
For international reporting and monitoring/evaluation of policy, landscape regions have been amalgamated to produce a classification comprising 10 agricultural regions, in which agricultural conditions are the most important component. The 10 regions are:

- Coastal districts of southern Norway and Nordland
- Lowlands of eastern and central Norway
- Forested districts of southern and eastern Norway
- Valley and highland districts of southern Norway
- Mountainous areas of southern Norway
- Fjord districts of western and central Norway
- Forested districts of northern Norway
- Fjord districts of Nordland and Troms
- Coastal districts of Troms and Finnmark
- Mountainous areas of northern Norway.

The classification system is, at present, not employed in the policy-making process. However, the National Monitoring Programme for Agricultural Landscapes which is designed to monitor status and trends in agricultural landscapes to aid policy development, will report at the level of agricultural regions. In addition, geo-referenced production subsidy records have been linked to the Landscape Reference System, enabling analysis of trends by region. The framework of the 10 agricultural regions thus promises to be a useful tool for policy decision-making, since it provides a common reference system enabling the linkage of policy information, socio-economics and landscape data.

Tourism/recreation

Austria: *Implementation of a new regulation on tourism and recreation activities in the wider countryside (German name of the study: Niederösterreichische Erholungsräume)*
Spatial and regional planning is as well as nature conservation administrated by the governments of the federal provinces or Bundesländer. Spatial planning is done by zoning and legislation, but also by directing subsidies or other financial incentives to certain regions or certain branches of economy. To strengthen the role of sustainable tourism and recreation activities, like hiking, biking, horse riding and others, a study was conducted to highlight the potential of different landscape types for several tourism activities. LCA was used for identifying spatial reference units and describing their potential for recreation activities, like hiking, biking etc. According to the different suitability for these activities, the landscapes have been ranked and the results visualised in a series of maps. The results have been used for re-allocating financial support to municipalities which want to invest in infrastructure for "soft tourism", like the marking of hiking trails, the maintenance of horse riding trails and biking routes and so on.

Norway: *The Norwegian Landscape Reference System (Puschmann, 1998)*
The Norwegian Landscape Reference System is integrated in "Arealis" – the spatial information system used in municipal and county planning. The system is based on the components: major landform; geological composition; waterways and water surfaces; vegetation; agricultural land; buildings, technical installations and infrastructure. Landscape character is seen as the combination of these components. The system is hierarchical with 45 landscape regions, comprising 444 landscape sub-regions, which are further subdivided into landscape areas. Examples provided of use of LCA are examples of use of this system, since this is the only system with national – or even regional coverage. As part of the EU Interreg IIC project "Sustainable development in coastal tourist districts of the North Sea Region", Aust-Agder county authorities commissioned mapping of coastal landscape types by NIJOS. This was to form the county management plan for the coast, taking account of national policy guidelines on development of coastal areas. The aim was to obtain an overview of which coastal types were present in the county, and an evaluation of the development challenges in the different landscape types. Nine landscape types were described: Open sea meeting the mainland and large islands; Open sea from the outer skerries; Outer

skerries; Inner islands, islets and skerries; Bays, coves and inlets; Sounds, straits and small fjords; Large fjords; Brackish deltas; Inland landscape of the large islands.

Spatial/rural development

Denmark: *Impact assessment scheme*
In the late 1990s focus has been put on the cultural environment. This has led to several initiatives towards method development on the part of the Danish Forest and Nature Agency. One of them is the development of guidelines for EIA on landscapes and cultural environment in the rural areas (see literature list). This is quite new, and specifies guidelines for those interests that are landscape related (meaning landscape aesthetic and perception), by looking at the character of the pressures and the vulnerability of the landscape and cultural environment. In this process the LCA is one of the elements.

Flanders: *Spatial-natural structure*
Spatial-natural structure of the planning area includes identification of biotic and geo-physical determining elements and processes of this area. It leads to interpretation of patterns and processes. Added to this a survey of cultural elements and dominant impact of land use and activities. Result: the landscape character and landscape ecological functioning. Mapped as areas, point like and linear features that serve as the Spatial Reference Frame for future developments. As 'ecologically sound spatial development' is the aim, this analysis provides in a systematic way the relevant information. Cartographic presentation and comprehensive descriptions turned out to serve as ideal means to structure and encourage public participation in the planning process.

Switzerland: *Landscape Character Assessment Canton Thurgau (http://ww3.tg.ch/default.cfm?treeID=863 (select item "LEK"))*
This instrument amalgates all policy sectors at the cantonal level. Main purpose is to attract new 'clean' businesses for this merely rural area of Switzerland. Emphasis is given to offer a clean environment, good education and attractive opportunities for recreation. Highly participatory approach. The cantonal policy is broken down to the community level (local zoning) with local planners and development and conservation schemes. The canton performs an active monitoring of (a) economic indicators, (b) environmental indicators, (c) census indicators. A causal relationship between Landscape Character Assessments (in Switzerland merely called Landscape development plan) is not achieved.

Regional policy

Hungary: *Act CXII/2000 on Regional Plan of Lake Balaton Recreational Area (Regulation of land-use-Containing instruction for management and conservation)*
It is a model regional plan, including territorial (land use and housing) regulation – voted by the Parliament. In this area – approximately 10,000 km^2 –, the interests of nature and landscape protection are conflicted with the interests of the recreational use and housing. The main objective of the plan is the protection of the ecological spatial structure and landscape character. The protected landscape scenery and Landscape Character Areas as well as landscape rehabilitation zones are designated in the plan. Land use patterns, geomorphologic landforms are to preserve, housing is prohibited and new infrastructure setting is allowed only under the ground. Regulation of landscape rehabilitation areas prescribes the rehabilitation of semi-natural land-cover.

Housing/town planning

The Netherlands: *Making Space, Sharing Space (Fifth National Policy Document on Spatial Planning (pdf 152 Kb, 71 pages)*
On 15 December 2000, the Cabinet ratified the draft Fifth National Policy Document on Spatial Planning entitled 'Making Space, Sharing Space'. This policy document contains the national government's spatial planning policy resolutions for the next few decades. The most important decisions are included in the draft Key Planning Decision for National Spatial Planning Policy. This publication summarises the policy document, using the same sequence of chapters as the full document and includes the full text of the draft Key Planning Decision. It provides all the information necessary for public participation, which is an important part of the Key Planning Decision procedure. The Key Planning Decision follows a procedure, consisting of 4 steps. The above-mentioned draft document was Part 1. By now Parts 2 and 3 have been completed as well: Part 2 consisted in collecting and publicising the comments received on Part 1; Part 3 is the adapted policy document, revised on the basis of the reactions in Part 2. Part 4, finally, will consist of the approval of the document by the Dutch Parliament. The impact of this plan on the environment and nature are constant monitored with LCA.

Landscape policy

Denmark: *Regional Planning Procedure*
In the Regional Planning Procedure, counties are requested to designate valuable landscapes for protection. This has principally been implemented in the mid-1980s, emphasising four to five main interests: biological/zoological, geological, cultural-historic, aesthetic/visual and recreational, and methods vary among counties. One county has specifically used LCA during the last plan period. This has provided a map of valuable landscapes with transparent criteria and methods. Moreover it has been possible to include aspects relates to perception and visual impression. This method is now under development for general use.

Germany: *Landscape programme of Brandenburg (2001)*
The diversity, character and beauty of nature and landscape are to be conserved and developed. Typical landscape characters have to be sustainable preserved. Landscapes rich in experiences have to be preserved and developed as a precondition for a close to nature recreation. They have to be protected against noise, harmful substances and visual impairments. The preservation, conservation and wary further development of spaces with an excellent character of the landscape

character as well as of historical cultural landscapes and parts of them are the essential precondition to strength the regional identity. The division of Brandenburg in natural regions is based on the regional distinctions and characters, which represent the richness of landscape diversity. They are a part of all thematic maps in the programme. This landscape classification serves as the spatial and temporal base for the registration and assessment of natural subjects of protection (soil, water, climate/air, species and biocoenosis and landscape character, recreation). The landscape programme of Brandenburg has a great advantage. It is based on the geographical classification of natural landscapes (units) and it doesn't use mainly administrative units. It is the most important conceptual base for all nature protection authorities for the development and update of the landscape framework plans. It is used for the whole federal state.

Germany: *Landscape framework plan of the county Hameln-Pyrmont in Lower Saxony (2001)*
The aims of this plan based on the Federal Nature Conservation Act, 4/2002. According to the landscape programme of Lower Saxony each natural region must have so many natural emphasised areas and structures that the specific diversity, character and beauty are visible. For the realisation of the objectives of nature protection and landscape conservation the classification of natural landscapes in Germany by E. Meynen and J.Schmithüsen has been used. Besides the whole county is divided in landscape character spaces (Landschaftsbildräume). The latter are aggregated to two types of landscape characters. The character of a landscape character space (Landschaftsbildräume) is assessed with the help of the following criteria: native character/natural impact, historical continuity and diversity. The objectives have been systematically concretised in a so-called subject of protection oriented objective concept on the base of landscape units in the county. The main objective of the objective concept landscape character is as follows: 'for the preservation and restoration of the landscape character there must exist so many by nature and culture emphasised biotopes, landscape structures and land use structures that the natural specific diversity, character and beauty of the space is visible and that it is a precondition for recreation'.

Germany: *Landscape programme of Saxony-Anhalt (1995)*
The objectives of nature protection and landscape conservation refer to all subjects of protection and the whole area that means the unsettled and settled regions. They are not restricted to protected areas. The sustainable and holistic protection of nature and landscape includes the long-term protection of landscape characteristic, soil, water, air and climate. The diversity, character and beauty of nature and landscape are to be conserved, developed and if necessary restored. Thereby for the cultural and recreational landscape historical important landscape parts, landscape structures and landscape characters are to be considered. The handbook for the classification of natural landscapes in Germany by E. Meynen and J. Schmithüsen and the handbook of the nature protection areas of the German Democratic Republic are the base for the five big landscapes and their 38 landscape units of Saxony-Anhalt. This landscape classification serves as the spatial and temporal base for the registration and assessment of natural subjects of protection (soil, water, climate, species and biocoenosis and landscape character). In Saxony-Anhalt such a landscape classification was used which points out the individuality of each single landscape. One important methodical criteria of this landscape classification is the landscape genesis. Besides the stable elements of a landscape (rock, relief, soil, vegetation, land use) were used because they provide information about the landscape character and the previous development. Each landscape unit is described by the following criteria: natural basics and landscape history (geology, geomorphology, soil, water, climate, and potential natural vegetation), present stage (landscape character, soil, water, air and climate, species and biocoenosis, land use), environmental objective or models (Leitbild), ecosystems worthy of protection and development. The landscape programme of Saxony-Anhalt has a great advantage. It is based on the geographical classification of natural landscapes (units) and it doesn't use mainly administrative units. It is the most important conceptual base for all nature protection authorities for the development and update of the landscape framework plans. It is used for the whole federal state.

The Netherlands: *Meetnet Landschap-monitoring network*
The Dutch 'Meetnet Landschap'-monitoring network is a network from the Ministry of Agriculture, Nature management and Fisheries with a systematic approach to monitor the effects of changes in the Dutch landscape. Several targets have been defined. One specific target 'landscape ecology' has been made operational by developing a core set of ecological landscape indices to monitor the landscape ecological quality of landscapes in the Netherlands on the landscape level.

Flanders
Traditional landscapes are defined, mapped and described. The Landscape Atlas of Flanders gives an inventory of the best-preserved relicts of the traditional landscapes = areas where the characteristic landscape structure (dating from the pre-1950s changes) can be recognised. These documents serve as the reference for the responsible administration to elaborate their obligatory advises regarding spatial developments of other policy sectors.

Switzerland: *Landscape 2020: LCA and indicator system at the federal level*
It includes two phases: a) development of an LCA for Switzerland and b) development of indicators for sustainable landscape development. Management plans are broken down to the cantonal level and should be implemented in the cantonal landscape assessments (LEK). The indicator system is used to generate a sustainability appraisal. Indicators are chosen in such a way that no additional monitoring program is necessary. More info at: www.umwelt-schweiz.ch/buwal/de/fachgebiete/fg_land/land2020/#sprungmarke5

Nature protection, natural and cultural heritage

Austria: ***Impact and policy assessment scheme***
In the Austrian biodiversity strategy it is foreseen to document the biodiversity values in a spatially explicit manner. Landscape Character Assessment has been used to identify those cultural landscape types of Austria, which are having the highest so-called nature value among all landscape types and the highest vulnerability on the other hand. Cultural landscape types have been used as spatial reference units in a GIS. Expert judgement on a set of criteria, like naturalness, maturity, rarity, vulnerability and others has been used to establish a decision tree for combining the assessed criteria. The resulting map of Austria is showing the national hot spots of biodiversity and also the policy demand in the field of landscape conservation and a nationwide strategy of nature conservation. Important background information is the fact that nature conservation in Austria is administrated at the regional level of the provinces or Bundesländer. There is no federal regulation on nature conservation in Austria. One political issue raised the exemplified study was, that there should be at least a legal framework at the national or federal level as well. This is especially true for landscape conservation, as landscapes do not stop at the borders of one province or Bundesland.

Cultural education

Portugal: ***Serra de Estrela Natural Park***
It is important to know the particular areas inside the park to understand the relationship between all its units that indeed are responsible of the character of the park. The main criteria to limit the landscape units were the hydrogeology of the park which defines one main division: the top of Serra da Estrela; the limit of the Natural Park which defines another important division, and among these divisions, the limits were defined by the socio-cultural and biophysical aspects, like land use and degree of human presence. This is all based on empiric knowledge of the area by a photographer/ designer and the technical staff of the park, and also based on the study made for the Biogenetic Reserve of the top of Serra da Estrela. The identification of the landscape units will be used for an exhibition; therefore the main purpose is environmental education. In this exhibition pictures, sketches, schemes and a model of the park will illustrate the landscape units.

Portugal: ***Guadiana Valley Natural Park Management Plan***
Landscape units were made for an academic purpose during the preparation phase of the Management Plan. The methodology was mainly expert judgements based on various physical, ecological and cultural criteria. After this, and because of the constitution of the National Park, an adaptation of these landscapes units was made and now is the one that is used but only for academic purposes. The landscape units are used in final courses thesis and masters. Could be used for increasing public awareness.

Portugal: ***Directorate for Physical Planning and Urban Development of Region of Alentejo***
In this project Landscape assessment is an essential instrument in the physical planning. The most important goal is that the units of the landscape guarantee that the units of the landscape will guarantee that the municipalities will change their point of view about their administrative limits, because they will start to see the landscape as a whole and stop considering only the landscape of their municipality. The fact to be an advisory document and not to have legislative character does not mean that it will not be used, because considering landscape in the process of physical planning today it is normal an all stakeholders will consider it. The scale of the project is 1:250000 and gives a short detailed reading of the territory but the target is to use it as a guide and later another detailed studies will be made. However the landscape assessment has not been published yet and it is necessary to inform all stakeholders at local, regional and national level to guarantee its use. The landscape assessment in Portugal is very important because the Portuguese consider more and more landscape, and in addition, European Union imposes it in the management processes.

Portugal: ***Landscape identification and characterisation in Portugal***
The National Study on identification and characterisation of Portugal is a new approach because it has a global view of the territory and this is completely new in Portugal. It has big potentialities for the better knowledge of the territory and an increased sensitivity of measures within agriculture policy to landscapes. A new methodology was used, a systematic one, and the goal is to make population aware of landscapes. The risk is that after the publication of this kind of studies, nobody uses them. However if the legislation of Physical Planning has a reference about the study, the study will have a stronger impact. After this step something more specified at regional scale should be done. It is important to work together with stakeholders of each region and also use some indicators, reference landscapes, consider some threats and get new purposes. More sketches, crosscuts, perspectives and maps like models that represent the changes of the landscape are very important as well. The Ministry of Agriculture tries to adjust their policies to the landscape, however the Ministry of Environment and the Ministry of Culture have not a global view of the landscape but a sectored one and it is difficult to deal with them.

Energy production

The Netherlands: ***Location of wind farms: LCA and indicator system at the regional and local level***
The Netherlands national policy is to have 10% of total energy in use by sustainable energy in 2020. Wind energy targets 2020:

- on land 1,500 MW in 2010
- at sea 6,000 MW in 2020.

The location aspect on visual and biological (birds) impact is part of an LCA.

An important implementation issue for wind farms is the risk of bird collision. A lot of the existing knowledge on birds and wind energy is based on studies at onshore sites. With respect to wind energy implementation especially offshore, more information about the environmental impact is needed. Several countries carrying out environmental base line studies focused on offshore wind farm sites. Monitoring wildlife is very labour intensive. The aim is to develop, demonstrate and evaluate a noise monitoring system, which identifies bird impacts and also indicates the species. The system must be relatively inexpensive, robust and applicable for offshore conditions. This way of detecting the collisions of birds can be very useful for the future implementation of offshore wind farms, but specific rule of LCA implementation cannot be given yet.

Transport

Switzerland: *Environmental impact assessment and LCA for trans-alpine traffic routes*

The principle goal of the trans-alpine traffic system (proposed end of the construction after 2010) is to increase trans-alpine capacity for passenger and cargo trains. It aims at reducing travel time between North and South Europe and seeks to be a highly attractive alternative to road transportation. At the same time it should be 'environmentally sound', ensure the quality of life of residents along the transit lines and is a welcome initiative for a more sustainable transportation system in Europe (http://www.blsalptransit.ch). Several federal decrees ask for Environmental impact analyses that incorporate a landscape assessment of the corresponding regions. (http://www.admin.ch/ch/d/as/2001/985.pdf). Management plans are broken down to the project level. There is a large monitoring program underway that measures direct effects of transit traffic (and its potential move from the road to the rail) e.g. noise, air pollutants and indirect impacts on people, landscape, biodiversity. It is part of the Reporting process to the European Union and governs the negotiations for trans-Alpine traffic quotas.

Mineral extraction

Germany: *A brown coal plan (1996) as a restoration framework plan of the opencast pit Cospuden in the south of Leipzig*

The plan contains a description of the state of nature and landscape before mining, the present state (geology, flora and fauna, landscape changes and natural scenery, protected and to be protected parts of landscape, land use, climate, water balance (ground and surface water condition), dust and noise exposure, abandoned sites) and the objectives of the plan (nature protection and landscape conservation, recreation, traffic, geological specific features representing geological witnesses [Zeugen]).

IV.2 Information sources

In order to fill in the policy checklist, the participating countries collected the information by a search on the Internet, reviewing documents and reports and interviewing experts and organisations. Listed below there is a directory, which contains the information sources used by country.

Austria

Web sources

- www.pph.univie.ac.at (University of Vienna-Department of Conservation Biology, Vegetation Ecology and Landscape Ecology)
- www.ubavie.gv.at (Federal Ministry of the Environment)
- www.lebensministerium.at (Austrian Federal Ministry of Agriculture, Forestry, Environment and Water management).

Denmark

Web sources:

- www.sns.dk (Danish Forestry and Nature Department) Protection of Nature Act
- www.lpa.dk (the Spatial Planning Department)-Spatial Planning Act
- www.lpa.dk/Topmenuen/Publikationer/Andre_sprog/2002/planning-act-2002.pdf. Ministerial order on supplementary rules pursuant to the Planning Act
- www.mem.dk/lpa/vvm/Min_Order_1999.pdf
- www.dffe.dk (The Directorate for Food, Fisheries and Agri-business).

Documents and reports:

- Capersen, O.H., A. Höll, V. Nellemann, A.O. Sorensen (2001, in Danish) Landscape evaluation – an examination of international and Danish methods. Danish Forest and Nature Agency http://www.skovognatur.dk/wilhjelm/endelig/pdffiler/landskabsevalueringfsl.pdf
- Danish Forest and Nature Agency, (2003, in Danish) Landscape and cultural environment http://www.skovognatur.dk/udgivelser/2003/landskab_kultur/helepubl.pdf
- Ministry of Environment (1999, in Danish): Nature management through ten years, 1989 to 1998
- Danish Forest and Nature Agency (2000, in Danish): Visualisation and EIA
- www.sns.dk/publikat/2001/visualiseringer.htm.

Interviews held with:

- Architect Anette Ginsbak, the landscape section, Danish Forest and Nature Agency
- Haraldsgade 53, DK-2100 Copenhagen OE. Phone +45 3947 2159
- Regional Planner Majbrit Jensen, Section for nature and environment, Funen County, Oerbaekvej 100, DK-5220 Odense. Phone +45 6556 1000
- Regional Planner, geographer, Michael Kavin, Section for nature and environment, Funen County, Oerbaekvej 100, DK-5220 Odense EO. Phone +45 6556 1000
- Architect Morten Hougaard, Section for Environment and Spatial planning, Vejle County, Damhaven 12, 7100 Vejle. Phone: +45 7583 5333.

Germany

Documents and reports:

- Federal Nature Conservation Act-Bundesnaturschutzgesetz von 2002
- Commentary to the Federal Nature Conservation Act-Kommentar zum Bundesnaturschutzgesetz von 2003
- Regional Planning Act of the Federal Republic of Germany-Raumordnungsgesetz der BRD von 1998
- Building Law Book-Baugesetzbuch der BRD von 1986
- Landscape programme of Brandenburg-Landschaftsprogrammm Brandenburg 2001
- Landscape programme of Saxony-Anhalt-Landschaftsprogramm Sachsen-Anhalt 1995
- Landscape framework plan of Hameln-Pyrmont-Landschaftsrahmenplan Hameln-Pyrmont (Niedersachsen) 2001.

Interviews held with:

- Matthias Herbert, Leader of the Federal Nature Conservation Agency Leipzig, Landscape planner (matthias.herbert@bfn.de)
- Jens Schiller, Federal Nature Conservation Agency Leipzig, Department of Landscape Planning, Landscape planner (jens.schiller@bfn.de)
- Dr Daniel Petry, UFZ Centre for Environmental Research Leipzig-Halle, Department of Economy, Sociology and Law, scientist (daniel.petry@ufz.de)
- Dr Burkhard Meyer, UFZ Centre for Environmental Research Leipzig-Halle, Department of Natural Landscapes, scientist (burghard.meyer@ufz.de).

Hungary

Web sources:

- www.kvvm.hu (Ministry of Environment and Water)
- www.nfh.hu (National Development Plan, Agricultural and Rural Development Operational Program)
- http://web.f-m.hu/miniszterium?kat=agrarkornyezetgazdalkodas:09000001 (National Agro-environmental Programme).

Interviews held with:

- Head of the National Office for Rural Development
- Head of the National Office for Regional Development
- Head of the Agro-Environmental Department of the Ministry of Agriculture and Rural Development
- Head of the Environmental Policy and Strategy Department in the Ministry of Environment and Water
- Head and several planners of the Department of Regional Planning in the Scientific Research and Planning
- Institute for Regional and Town Planning
- Head of the National Bureau for Landscape Protection in the Ministry of Environment and Water
- Head of the National Forestry Service
- Co-ordinator of the Planning of the National Forest Strategy.

Ireland

Landscape Alliance Ireland are involved in a continuous process of gathering and analysing information relating to all landscape issues both in Ireland and elsewhere. The information in this policy checklist reflects that continuous process.

Interviews held with:

- Mr John Martin, Principle Planning Advisor, Department of the Environment, Heritage and Local Government, Custom House, Dublin 1. Phone: + 353 1 8882713
- Mr John Laffan, Department of the Environment, Heritage and Local Government, Custom House, Dublin 1. Phone: + 353 1 8882000
- Mr Michael Starrett, Chief Executive, The Heritage Council, Kilkenny, Ireland. Phone: + 353 56 7770777
- Mr Brendan O'Sullivan, Policy Planning Unit, Cork County Council, Model Farm Road, Cork, Ireland. Phone: 353 21 4933100
- Mr Diarmuid T. McAree, Forest Service, Department of Communication, Marine and Natural Resources, Leeson Lane, Dublin 2, Ireland. Phone: 353 1 619 9381; Fax: 353 1 662 3180; Email: dtmcaree@indigo.ie.

The Netherlands

Web sources:

- www.minlnv.nl (The Ministry of Transport, Public Works and Water Management)
- www.minlnv.nl/international/policy/green/rural/
- www.minlnv.nl/international/policy/green/rural/ukinftgsw1.htm
- www.minlnv.nl/international/policy/plant/forestry/
- www.minlnv.nl/international/policy/green/recreation/
- www.minlnv.nl/lnv/algemeen/eclnv/landschap/meetnet.html
- www.minvrom.nl (Ministry of Spatial Planning, Housing and the Environment-VROM).

Documents and reports:

Official documents from National and Provincial Agencies.

Norway

Documents and reports:

- The Land Act (12 May 1995, no. 23)
- Parliamentary bill of the Ministry of the Environment 2003
- White paper No. 25 (2002–2003); Governmental environmental policy and state of the nation
- National strategy for a sustainable development (Dept. of foreign affairs 2003)
- White paper No. 19; On Norwegian agriculture and agricultural production (1999–2000)
- In the Nordic strategy for a sustainable development.

Interviews held with:

- Ministry of Agriculture
- Ministry of Environment
- Directorate for Nature Conservation
- Directorate for Cultural Heritage
- Norwegian Agricultural Authority.

Portugal

Web sources:

- www.dgaa.pt (Directorate-General for Local Authorities)
- www.dgotdu.pt (Directorate for Physical Planning and Urban Development)
- www.icn.pt (Institute for Nature Conservation- ICN)
- www.agroportal.pt
- www.ippar.pt (Portuguese Institute of architectural heritage)
- www.espigueiro.pt/dourovinhateiro/pt (Regional Information Centre)
- www.despodata.pt/geota/publicações/gac (Information System-MoreData).

Interviews held with:

- Alexandre Cancela de Abreu, Professor, Landscape Architect, University of Évora
- Mª da Paz Moura, Landscape Architect, Serra da Estrela Natural Park
- Nuno Lecoq, Landscape Architect, Vice-Director of Directorate for Physical Planning and Urban Development of Region of Alentejo (DGOTDU)
- Adviser Rosário Oliveira, Landscape Architect, Guadiana Valley Natural Park Management Plan
- Teresa Avelar, Head of Environmental Assessment Ministry of Agriculture.

Switzerland

Web sources:

- ww3.tg.ch/default.cfm?treeID=863 (Landscape Character Assessment-Kanton Thurgau)
- www.admin.ch/ch/d/as/2001/985.pdf (Environmental impact analyses that incorporate a landscape assessment of the corresponding regions).

Documents and reports:

- Swiss Landscape Concept
- Official documents from Federal and Cantonal Agencies.

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European Landscape Character Areas

In recent years, Landscape Character Assessment has become central to the sustainable development and management of land. It is recognised as an important tool for policy makers and stakeholders, which provides them with quantitative and qualitative evidence to reach a dynamic management adjustable to new demands of regional identity. In response to this need, the expert network Landscape Europe launched the European Landscape Character Assessment Initiative (ELCAI). The goal of the project was to review state-of-the-art landscape character assessment at the national and international level and to analyse the role of policies and stakeholders at various levels. Synthesising the results of an international stakeholder workshop and of research activities in14 participating countries, this richly illustrated final report provides a detailed account of all findings and presents recommendations for future applications.

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